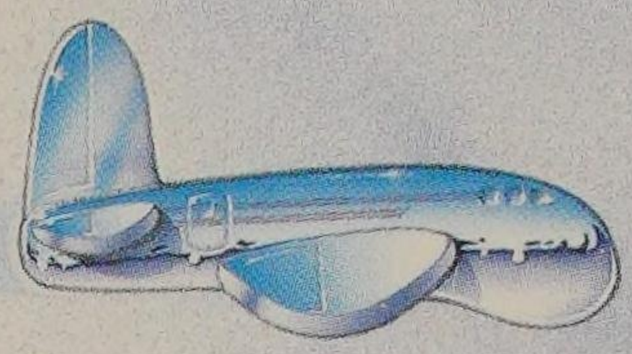
FLYING ON INSTRUMENTS with Flight Simulator



Jonathan M. Stern

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FLYING ON INSTRUMENTS

with Flight Simulator

Jonathan M. Stern

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Foreword

You've flown *Flight Simulator* countless times, been sightseeing from Puget Sound to Martha's Vineyard, and can put your airplane down on the shortest landing strip. But unless you can fly in the worst conditions—through heavy clouds, in the dark of night, with low visibility—you're only a *fair-weather pilot.*

To fly in bad weather—just as every professional pilot does—you must use your airplane's instruments. You must know what each instrument is for, how to read it, and how to use those readings to navigate, fly, and land your aircraft.

Flying on Instruments with Flight Simulator is your tutor and guide to this new and challenging aspect of *Flight Simulator* and *Flight Simulator II.* Written by a pilot/instructor who is instrument rated (and who worked as an air traffic controller at Washington National Airport), this book will make you an *all-weather,* not just fair-weather, pilot.

You'll learn how your instruments operate, and what they're telling you. You'll learn how to climb, bank, and dive under complete control, with only instruments to guide you. And you'll learn how to navigate using the same kinds of charts real pilots use.

Then you'll delve into the instrument-rated pilot's world. You'll learn how to read and use Instrument Approach Procedure (IAP) charts—charts so vital to pilots that they're updated every 56 days by the Federal government. You'll execute actual instrument approaches, using actual charts, as you take off, fly, and land your airplane under less-than-perfect weather conditions.

Flight Simulator and *Flight Simulator II* provide three methods of navigating and landing with instruments. These three methods—VOR, NDB, and ILS—are thoroughly explained and illustrated. Then it's your turn as you fly VOR radials, read your ADF as you approach a nondirectional beacon (NDB), or stay on the ILS glideslope.

That's just the beginning. Once you've mastered flying on instruments in *Flight Simulator* (and you will have by the time

you finish this book), you can use the more than 100 IAP charts to fly on instruments, on your own, into and out of most of the simulations airports.

Flying on Instruments with Flight Simulator can be used with any version of *Flight Simulator* or *Flight Simulator II*, with Atari, Atari ST, Apple, Amiga, Commodore 64/64C/128, IBM PC/PCjr, or Macintosh personal computers.

Learn to fly on instruments, not by the seat of your pants, with *Flying on Instruments.*

Dedication

To my wife, Joy, who has put up with my many hundreds of hours at the computer.

Introduction

Thousands of airplanes take off, fly to distant places, and land every day. There are many different types of airplanes and many different types of pilots. Some pilots fly to earn a living; some fly strictly for pleasure.

Perhaps more numerous than the daily airplane flights are the copies of *Flight Simulator*—the extremely popular flight simulation available on a host of microcomputers—which have been sold. People of all ages and all professions use *Flight Simulator.* For pilots, *Flight Simulator* is an opportunity to try things they wouldn't dare try in a real airplane. For nonpilots, *Flight Simulator* provides fantasy, education, and diversion.

No More Weekend Pilots

Pilots who fly for pleasure are sometimes called *weekend pilots.* As their name implies, they fly on fair-weather weekends. Most professional pilots, on the other hand, are licensed to fly on instruments, so that when the ceiling is low or the visibility is reduced, their flights aren't canceled.

Flying on Instruments with Flight Simulator can take you from being a weekend *Flight Simulator* pilot and turn you into a professional *Flight Simulator* pilot. You'll quickly see that instrument flying on *Flight Simulator* makes the simulation even more challenging and even more enjoyable.

Flying on Instruments with Flight Simulator lets you go a step further. The book teaches you how to take off, fly to another airport, and land when the clouds are only 200 feet above the ground. It teaches you how to read and fly the instrument approach procedure charts that instrument-rated pilots use daily. And it provides you with the actual instrument approach procedure charts for the geographic regions included on *Flight Simulator* software:

- Boston/New York
- Southern California
- Chicago
- Seattle
- San Francisco (not on all versions)

Flying on Instruments with Flight Simulator is *not* an instrument-flying training program. If you are not qualified and licensed to fly an airplane in instrument conditions before you read this book, you won't be when you finish. The Federal Aviation Administration prescribes stringent requirements for airplane pilots, and the *Flight Simulator* software, with or without instruments, obviously does not meet these requirements.

Before trying to learn instrument flying from this book, you should be familiar with visual flight on your own version of *Flight Simulator*. Know all of your controls, such as throttle, aileron, flaps, and cloud-height adjustment.

Because this book may be used with any version of *Flight Simulator* on any computer, references to specific controls (function keys, joystick, or mouse, for instance) are not made. Any reference to *Flight Simulator* includes *Flight Simulator* and/or *Flight Simulator II*.

What's Here

Chapter 1 explains the function of the flight instruments.

Chapter 2 shows how to fly various maneuvers with reference to your flight instruments. This is called *basic attitude instrument flying*.

Chapter 3 describes the charts that you'll use to fly on instruments with *Flight Simulator*.

Chapter 4 describes how you'll use the aircraft electronic equipment (avionics) to begin an instrument flight, and then lets you practice departing on instruments.

Chapters 5, 6, and **7** take you through VOR, NDB, and ILS instrument approaches.

Chapter 8 shows you some variations on the basic procedures with which you will already be familiar. You'll learn how to make approaches to land over water at night and what to do when part of your instrument landing system fails and you're in the clouds.

The **Appendices** contain the charts that will guide you down in the worst of weather, show you the procedure for taking off again before the weather clears, and plot your longest flights.

At the beginning of each chapter, if necessary, instructions are given on parameters to set up with *Flight Simulator*. As you go through the various maneuvers and procedures, you should pause the simulation whenever you find it necessary to read ahead. Then undo the pause and continue.

If you're ready to begin, sit down at your computer, strap in, and turn to Chapter 1. Get set to fly on instruments with *Flight Simulator*.

Chapter 1

Flight Instruments

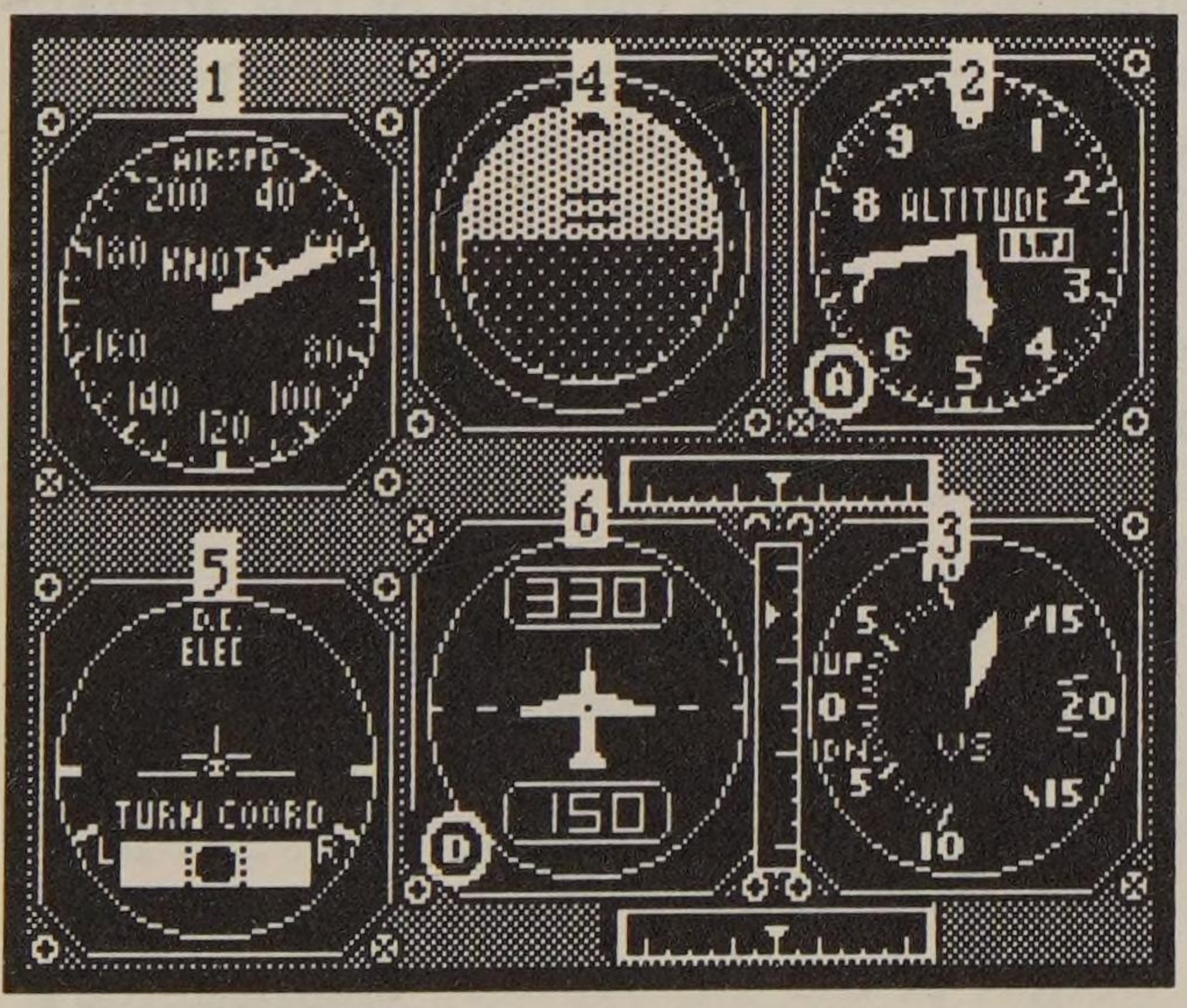
Chapter 1
Flight Instruments

Six flight instruments form the basis of flying on instruments. Knowing what each does, and how, is important.

Other than the need to know *where* you are, why do you need instruments in the airplane? Believe it or not, the human ability to sense which way is up is easily deceived in an aircraft. Balance control, other than through visual cues, comes from your inner ears. When you fly in clouds or in areas of restricted visibility, you depend on your inner ears to tell you which way is up. Unfortunately, your inner ears can't handle the job. That's why you need instruments.

Six flight instruments are found in almost every instrument-equipped aircraft (Figure 1-1).

Figure 1-1. Flight Instruments

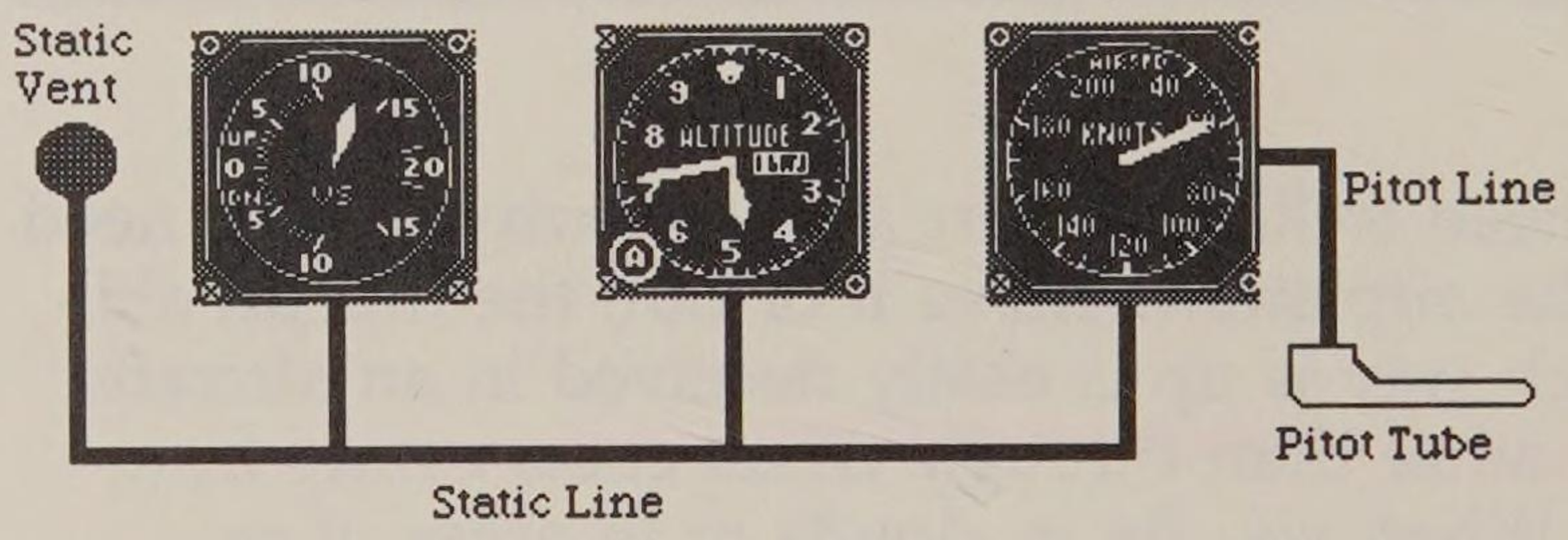


1. Airspeed Indicator
2. Altimeter
3. Vertical-Speed Indicator
4. Attitude Indicator
5. Turn Coordinator
6. Heading Indicator

Airspeed Indicator

The airspeed indicator shows the *indicated airspeed* of the airplane in nautical miles per hour, commonly called *knots*. The airspeed indicator, vertical-speed indicator, and altimeter are components of the Pitot-static system (Figure 1-2).

Figure 1-2. Pitot-Static System



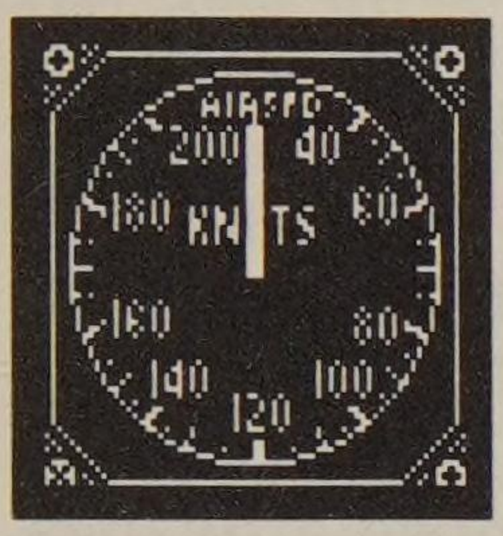
Three instruments—from left to right, the vertical-speed indicator, altimeter, and airspeed indicator—operate from the Pitot-static system.

The Pitot tube and static vent are mounted outside the airplane. The Pitot tube is positioned so that its front faces into the stream of air—the air rams into the opening. The static vent is usually flush-mounted on the side of the airplane so that there's no impact air measurement—in other words, the air doesn't rush into the vent. The airspeed indicator works by measuring the *difference* between the ram air pressure in the Pitot tube and the static air pressure in the vent.

To fully understand how these instruments operate, you have to understand some characteristics of air in the earth's atmosphere.

Air has weight: On a standard day at sea level when the temperature is 59° Fahrenheit, the atmosphere weighs 14.7 pounds per square inch (ppsi). Using a pressure measuring device called a barometer, this 14.7 ppsi equals 29.92 inches of mercury. Because air has weight, as you ascend from sea level, there is less air above you and, therefore, less weight on you. The rate at which the weight of the atmosphere changes isn't constant, but at the altitudes at which most single-engine airplanes fly, each 1000-foot increase in altitude results in a pressure decrease of approximately one inch of mercury.

Figure 1-3. Airspeed Indicator



When the airplane is parked on the ground, the Pitot tube senses the ambient air pressure (assuming no wind). Since the difference between the pressure in the Pitot tube and the pressure in the static vent is 0, the airspeed indicator indicates an airspeed of 0.

When the airplane is in flight, the pressure in the Pitot tube is greater than the ambient pressure measured by the static vent. This pressure difference is indicated as airspeed on the airspeed indicator.

If the airplane flies at sea level on a standard day (the pressure is 29.92 inches of mercury and the temperature is 59° Fahrenheit), the indicated airspeed accurately reports the speed at which the airplane is moving through the air. When the airplane is operated at other altitudes or in nonstandard atmospheric conditions, the indicated airspeed doesn't accurately reflect the *true airspeed*. But true airspeed can always be calculated if temperature, pressure, and indicated airspeed are known.

Measure True Airspeed

For *Flight Simulator* purposes, your true airspeed can be estimated by multiplying your indicated airspeed by 1 plus 1.5 percent for each 1000 feet above sea level that you're flying.

For example, if you're flying at 5000 feet with an indicated airspeed of 100 knots, your true airspeed is approximately 107.5 knots (100 * [1 + 5(.015)]).

True airspeed is *not* the speed at which the airplane moves over the ground. To compute *groundspeed,* any headwind must be subtracted from, or any tailwind must be added to, the true airspeed.

Altimeter

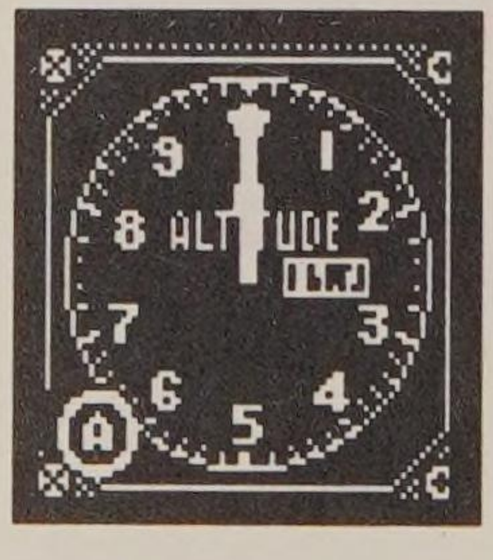
The altimeter is the only instrument which shows how high the airplane is above some level. The altimeter has two hands like those of a clock and a small indicator that appears near the numbers on the outer ring of the gauge. The large hand

indicates hundreds of feet. The small hand shows thousands of feet. The small indicator indicates tens of thousands of feet. The altimeter in Figure 1-2 shows an altitude of 4720 feet.

The altimeter is an aneroid barometer that displays pressure in feet above sea level (mean sea level), not above ground level. The altimeter cannot work accurately unless the pilot sets it to the current altimeter setting, which is the pressure at sea level under existing atmospheric conditions. The Federal Aviation Regulations require pilots of radio-equipped airplanes to keep the altimeter set to the "current reported altimeter setting of a station along the route and within 100 nautical miles of the aircraft."

The altimeter measures the barometric pressure in the static vent.

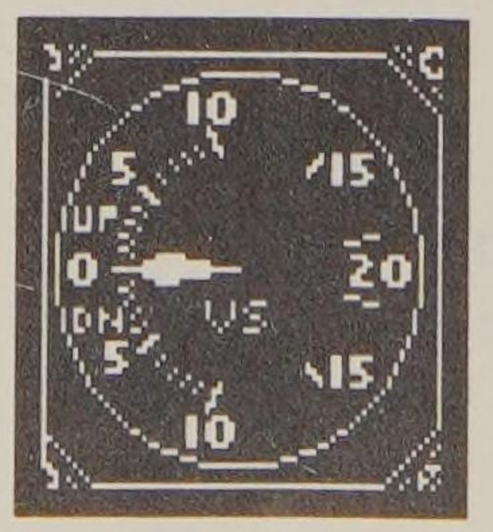
Figure 1-4. Altimeter



Vertical Speed Indicator

The vertical speed indicator, like the altimeter, is connected only to the static vent. The vertical speed indicator shows whether the airplane is flying at a constant altitude, climbing, or descending, and if climbing or descending, at what rate. The face of the instrument is graduated in hundreds of feet per minute, with the top half showing climbs, and the bottom half, descents.

Figure 1-5. Vertical Speed Indicator

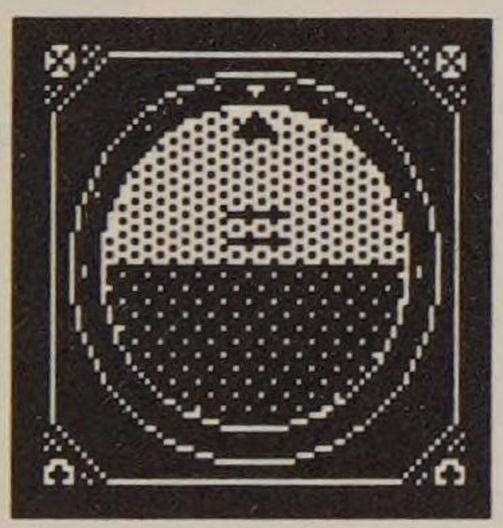


Attitude Indicator

The next three instruments—the attitude indicator, turn coordinator, and heading indicator—are gyroscopic instruments. Each instrument uses a gyroscope to maintain its orientation relative to one or more of the axes of the airplane.

The attitude indicator, as its name implies, indicates the attitude of the airplane relative to the earth's surface. The instrument displays airplane *pitch* (whether its nose is up or down) and airplane *bank* (the angle the wing forms with the horizon). Marks around the top half of the instrument on some versions of *Flight Simulator* indicate angles of bank of 10°, 20°, 30°, 60°, and 90°.

Figure 1-6. Attitude Indicator



Turn Coordinator

The turn coordinator is actually two instruments in one. The airplane replica in the middle of the instrument rolls proportionally to the roll rate of the airplane. When the bank angle is maintained, the replica indicates the rate of turn. When the right or left wing of the replica is aligned with the lower mark, the airplane is turning at a rate of 3° per second (so a full 360° turn takes two minutes). This rate of turn is known as *standard rate.*

The other instrument in the turn coordinator is called an *inclinometer.* The inclinometer shows whether or not use of rudder and aileron is coordinated. If the ball in the liquid-filled glass tube moves outside of the center of the tube, the rudder and ailerons are not coordinated. If the ball moves to the outside of the turn, the airplane is skidding. If the ball moves to the inside of the turn, the airplane is slipping.

Uncoordinated flight can always be corrected by applying sufficient rudder pressure on the same side as the ball so that it returns to the center of the tube. This is known to student pilots as "stepping on the ball," because the rudder is controlled by pedals; pressure on the left pedal coordinates the

turn if the ball is to the left of center, and pressure on the right pedal coordinates the turn if the ball is right of center.

Flight Simulator gives you the option of flying with auto-coordination. This lets you control the ailerons and have the proper amount of rudder automatically applied. I recommend that you use auto-coordination for learning to fly on instruments. Later, if you want, you can try what you've learned without auto-coordination.

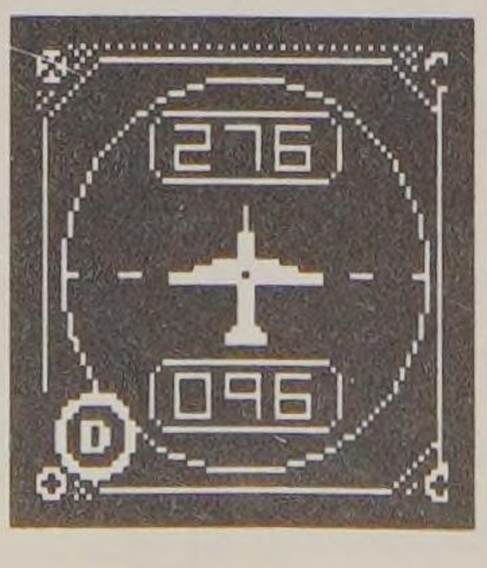
Figure 1-7. Turn Coordinator

From left to right, these three turn coordinators show left standard rate turn slipping, coordinated, *and* skidding.

Heading Indicator

The third gyroscopic instrument is the heading indicator. The heading indicator is used because a magnetic compass only works accurately when the airplane is flying straight and level in unaccelerated flight. Any time the airplane is banked, pitched, accelerated, or decelerated, the magnetic compass gives a wrong reading. The heading indicator solves this problem by using a gyroscope instead of a magnet. The heading indicator has its own error, however. Bearing friction causes the heading indicator to creep from the heading to which it has been set. Therefore, the heading indicator should be reset to the magnetic compass every 10 or 15 minutes, but only when the airplane is straight and level in unaccelerated flight.

Figure 1-8. Heading Indicator



Chapter 2

Basic Attitude Instrument Flying

Chapter 2

Basic Attitude Instrument Flying

Learning how to scan the instruments—the right ones and in the right order—puts you on the right track for flying on instruments.

The basic formula for flying an airplane is

Attitude + Power = Performance

This formula simply states that for any given attitude (pitch and bank) and power setting, a certain performance will result. If you understand this formula, you'll understand what *instrument scanning* is all about.

Scanning

While flying in clouds, or when the ground isn't visible, pilots must constantly be aware of the attitude, power setting, and performance of their airplane. Since the sense of balance isn't adequate to keep an airplane flying right side up, the pilot must scan the instruments to make sure things are as they should be.

Although many different scan patterns may work, most instrument-flying authorities recommend a pattern that includes checking the attitude indicator between checks on every other instrument. Since attitude plus power equals performance, once you've set the power, it's imperative to set and maintain the desired attitude.

After checking the attitude indicator, scan the other instruments to verify that the desired performance actually occurs. If it does, then check the attitude indicator again to insure that the attitude is maintained. But if the performance is not what you want, use the attitude indicator to correct the attitude. This may sound complicated, but it's not—at least not when you're in the airplane looking at your instruments.

Chapter 2

The exact scan pattern you use depends on the maneuver you're performing. All possible maneuvers of an airplane have only four fundamental components:

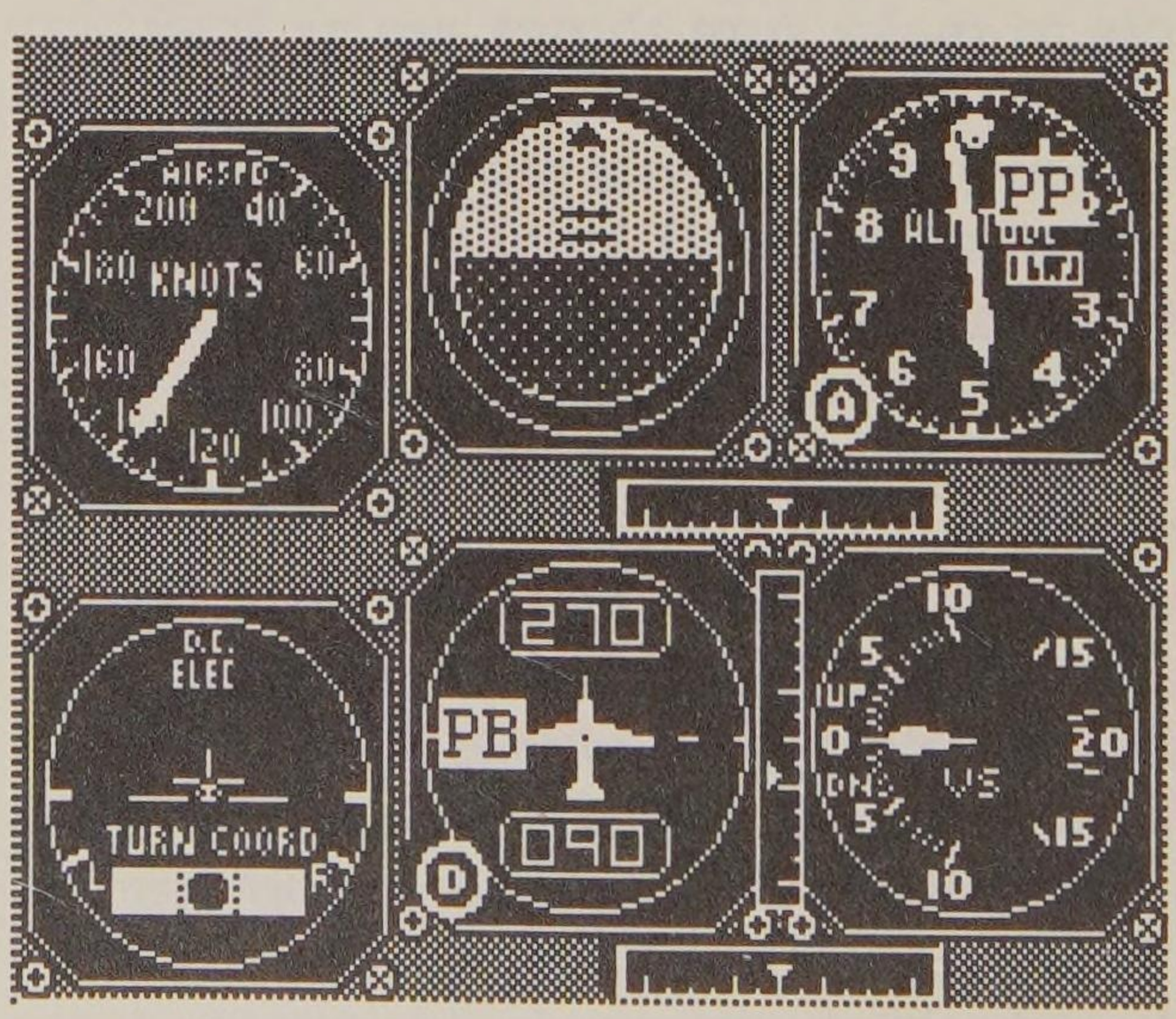
- Straight and level
- Climbs
- Descents
- Turns

These components—alone or in combination—cover all possible flying maneuvers. For each component, there's one instrument which gives the primary indication of pitch performance (PP), one instrument that gives the primary indication of bank performance (PB), and one instrument that gives the primary indication of power performance. The primary pitch and primary bank instruments vary with the maneuver component being performed. *But the primary power instrument is* always *the airspeed indicator.*

Straight and Level

Figure 2-1 shows the instruments of an airplane in straight and level flight. The aircraft is flying at 4980 feet, with an airspeed of 140 knots, and on a heading of 270°.

Figure 2-1. Straight and Level



In straight and level flight, the primary indicator of pitch performance (PP) is the altimeter. The primary indicator of bank performance (PB) is the heading indicator.

To maintain straight and level flight, the pilot might use this scan technique:

Attitude indicator—wings level, pitch level

Altimeter—20 feet below desired altitude

Attitude indicator—pitch up slightly to climb to 5000 feet

Heading indicator—right on heading

Attitude indicator—maintain wings level

Altimeter—approaching 5000 feet

Attitude indicator—pitch down slightly to maintain 5000 feet

Airspeed indicator—as desired

The scan should occasionally encompass the other instruments. For straight and level flight, the altimeter gives the primary indication of pitch performance and the heading indicator gives the primary bank-performance information. If the altimeter and heading indicator remain on the same marks, the airplane is flying straight and level.

The airspeed indicator is *always* the primary performance indicator for the power setting. The more power (throttle) applied, the faster the airspeed. Throttle back on the power and the airspeed drops.

In straight and level flight, it's useful to occasionally scan the vertical-speed indicator and the turn coordinator as back-ups to the primary instruments. If the vertical-speed indicator shows a 1000-foot-per-minute descent when the altitude is holding steady on the altimeter, there must be a problem with one of those two instruments. A third instrument can be checked to determine which of the two is malfunctioning. If the airspeed is normal for the throttle setting and level flight, then the pilot determines that the vertical-speed indicator is malfunctioning. On the other hand, if the airspeed is excessive, the pilot decides that the altimeter is not functioning.

Practice flying straight and level now. When the airplane is standing still on the ground, the instrument readings—with the exception of the airspeed indicator—will be similar to readings during straight and level flight. The attitude indicator will show wings level and level pitch; the altimeter will remain constant; the turn coordinator will be level; the heading indicator will remain constant; and the vertical speed indicator will be on 0.

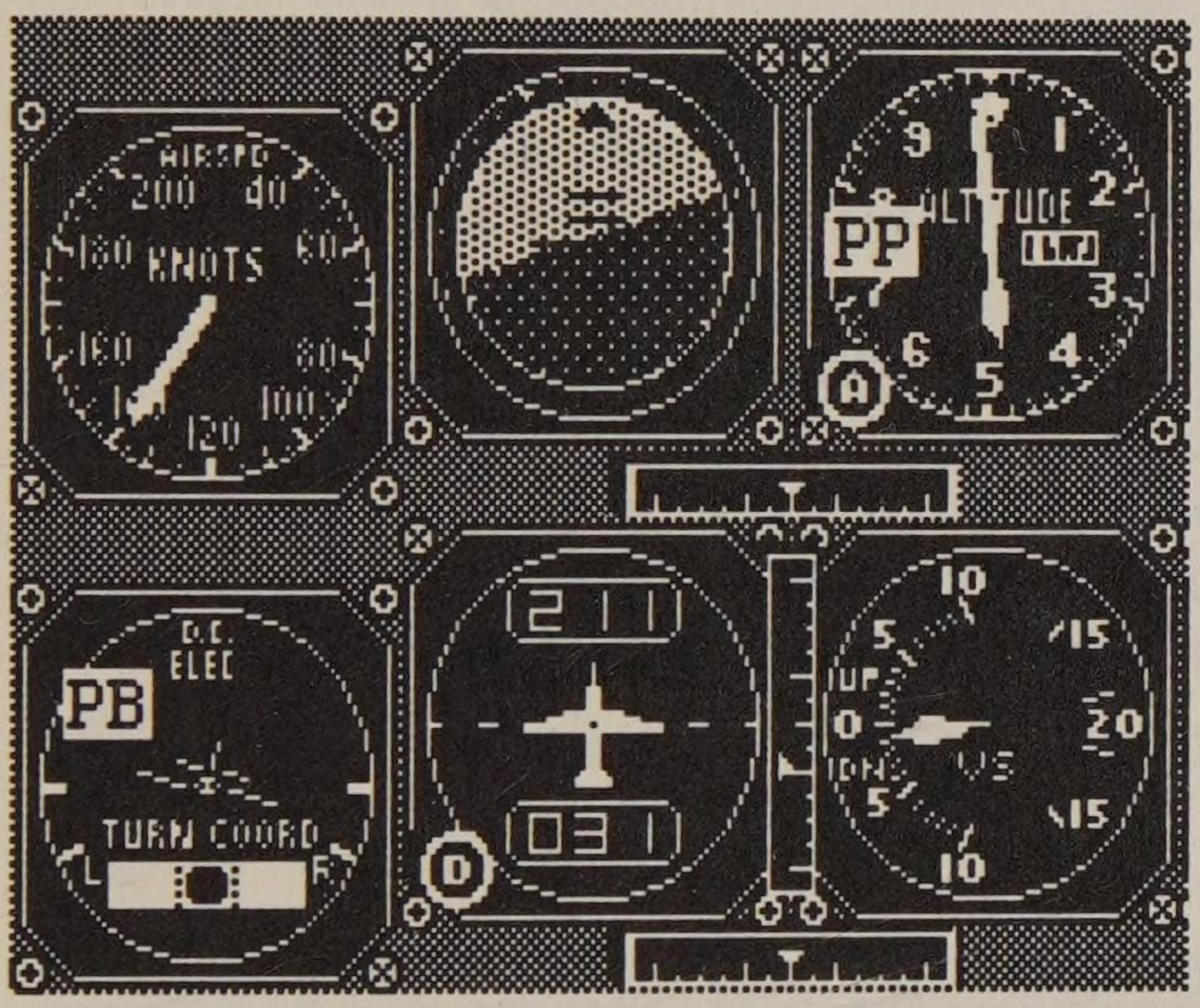
Take off, climb to 5000 feet, and fly straight and level on a 270° heading. Try using the instrument-scan pattern described above. Look out the various windshield views to correlate what you see with the instrument readings. When you feel comfortable with straight and level flight, pause the simulation and continue reading.

Right Turn

Figure 2-2 shows the instrument panel of an airplane in a level right turn. As in straight and level flight, the altimeter is the primary pitch instrument in a level turn.

In this turn, the pilot is trying to maintain a standard rate turn. Therefore, the turn coordinator becomes the primary bank instrument and should take the place of the heading indicator in the scan pattern described for straight and level flight. If the pilot chose to make a 30° banked turn instead of a standard rate turn, then the attitude indicator would become the primary bank instrument (this is the only situation in which the attitude indicator is a primary performance instrument).

Figure 2-2. Right Turn



In a level-turn maneuver, the altimeter serves as the primary pitch (PP) instrument, while the turn coordinator becomes the primary bank (PB) instrument.

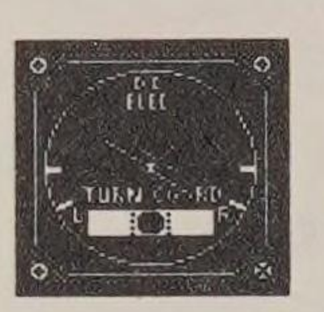
The scan pattern for this right turn might be

Attitude indicator—shows approximately 20° right bank and level pitch. The bank angle necessary for a standard-rate turn can be estimated using the following formula:

Bank angle = Airspeed [Knots] / 10 + 7

Altimeter—at desired altitude

Attitude indicator—same appearance as last scan



Turn coordinator—shows standard-rate right turn

Attitude indicator—same as last scan

Airspeed indicator—at desired cruise speed

Attitude indicator—same as last scan

Heading indicator—are you approaching your desired heading? As a rule of thumb, rollout of the turn should begin when the airplane is within one-half of the bank angle of the desired heading. If a 20° bank is used in the turn, and the desired heading is 260°, begin your rollout when passing through heading 250°.

Unpause *Flight Simulator* now and practice making turns to predetermined headings while maintaining 5000 feet. Practice both left and right turns.

As a general rule for flying on instruments, never use a turn steeper than standard rate or a bank angle greater than one-half the number of degrees to turn, whichever is less. Thus, if you want to turn through 40° of heading, don't use a bank angle steeper than 20°.

When you feel comfortable with both left and right turns, pause and keep reading.

Climb

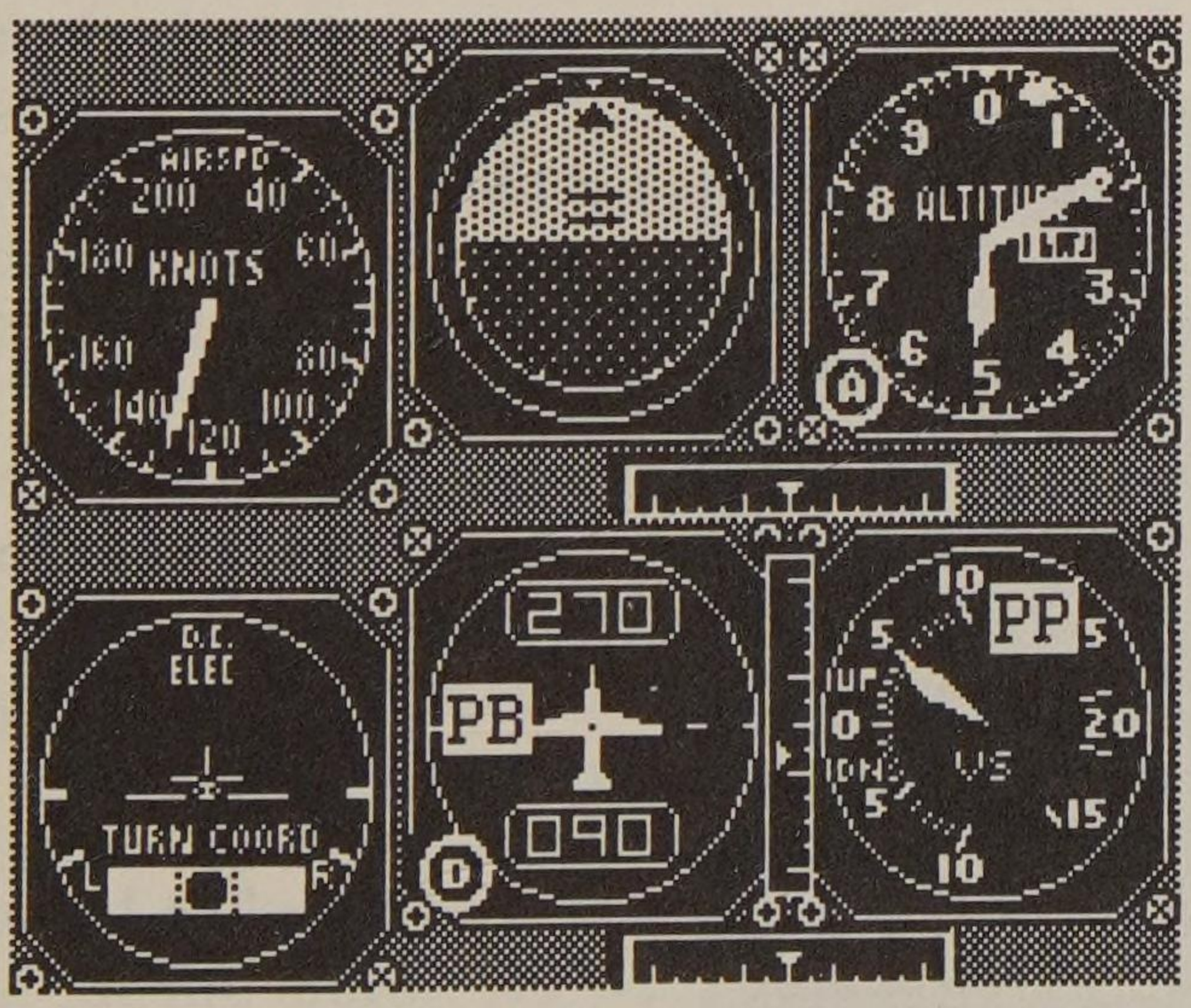
Take a look at Figure 2-3, which shows the instruments of an airplane climbing at 500 feet per minute. Because a straight climb (without banks or turns) is being made, the heading indicator is the primary bank instrument. If the heading doesn't change, then the wings are level.

The vertical speed indicator is the primary pitch instrument for a *constant-rate* climb.

On the other hand, if you wanted to climb at a *constant airspeed,* not at a constant rate, the airspeed indicator would be the primary pitch instrument instead.

For a *constant rate, constant airspeed* climb, adjust the airplane pitch to establish the rate of climb (500 feet per minute, for instance); then adjust the throttle setting to maintain the desired airspeed. You may need to correct both the pitch and power setting to keep climbing at the same rate and with the same airspeed.

Figure 2-3. Climb



In a straight climb at a constant rate (as shown by these instruments), the heading indicator is the primary bank (PB) instrument, and the vertical speed indicator is the primary pitch (PP) instrument.

The instrument scan should include the secondary instruments—both as a backup and so that you know when to level off at the desired altitude. As a rule of thumb, the level-off should begin when the altitude is within 1/10 the rate of climb. For example, if the desired altitude is 6000 feet and the rate of climb is 500 feet per minute, begin leveling off as the airplane passes through 5950 feet.

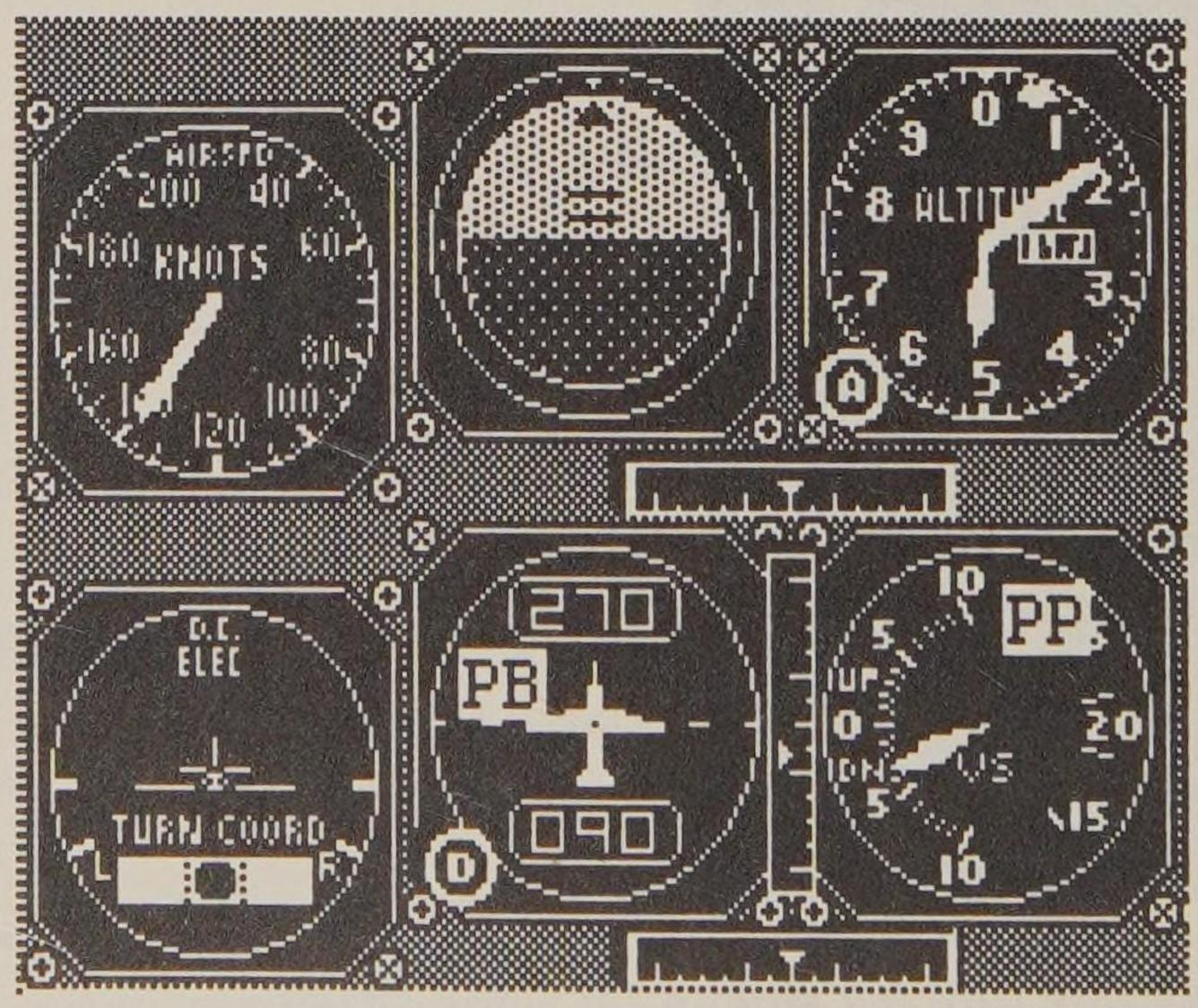
Practice by climbing from 5000 feet to 6000 feet on a constant heading at 500 feet per minute while maintaining 80 knots. Keep trying to do it until you get everything right.

Descent

A constant-rate descent, as shown in Figure 2-4, is not much different from a constant-rate climb. The same primary instruments are used.

The major difference is that in the descent, earth's gravity is working for you rather than against you. Because of this, it's possible to build up excessive speed, speed that demands that you reduce the throttle setting.

Figure 2-4. Descent



The same primary instruments—the heading indicator and the vertical speed indicator—are used when conducting a constant-rate descent as when in a constant-rate climb.

Additionally—again because of gravity—the level-off should begin when the airplane is passing through an altitude 1/5 the rate of climb from the desired altitude. If the airplane whose instruments appear in Figure 2-4 is descending to 5000 feet, the pilot should begin leveling off when the airplane passes through 5080 feet (400 feet per minute divided by 5 equals 80 feet).

Descend from 6000 feet to 4000 feet at 1000 feet per minute while maintaining 120 knots. If you do it just right, it will take you exactly two minutes and you'll travel four miles.

Climbing/Descending Turns

You've learned how to use your instruments to perform the four fundamental flight maneuvers. All that remains of basic attitude instrument flying are the two hybrids, *climbing* and *descending turns.*

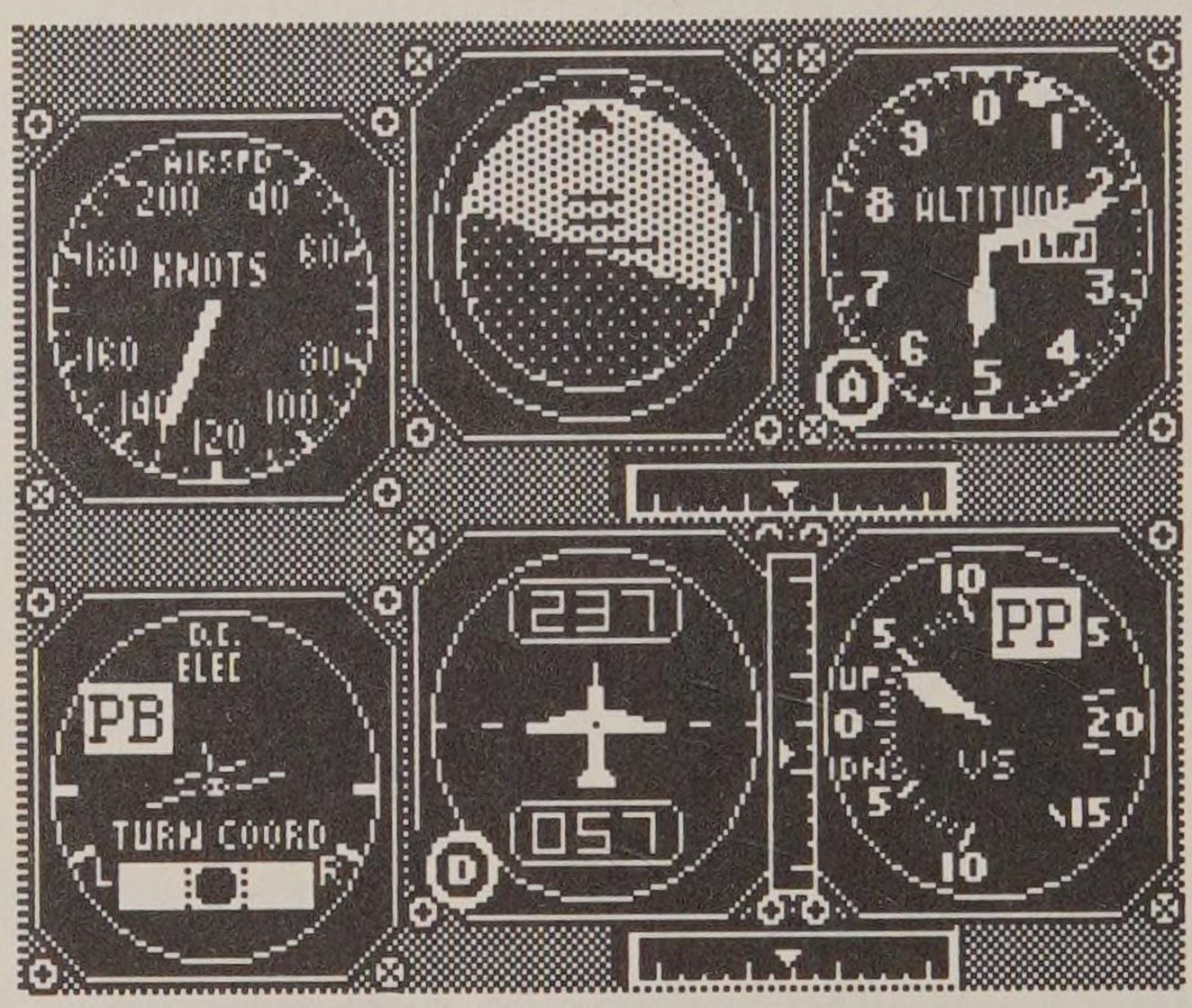
These maneuvers are simply combinations of the components you've already seen demonstrated. If they appear more difficult, it may be due to the fact that more things are going on at the same time. In a climbing turn, for instance, not only is the heading changing, but the altitude is increasing. Therefore it's more important that you continue to scan the instruments and not fixate on any particular one. If you study only one instrument—say, the altimeter—it's likely you'll neglect to roll out on your desired heading.

Since the airplane shown in Figure 2-5 is making a standard-rate turn, the turn coordinator provides the primary indication of bank performance. And because a constant-rate climb is being carried out, the vertical speed indicator is the primary pitch performance instrument.

The heading indicator and altimeter serve as secondary pitch and bank instruments and provide the information you'll need to know in order to roll out of the turn and level off from the climb. As with all maneuvers, the airspeed indicator serves as the primary power performance indicator.

Begin the rollout from the turn when the heading is within 1/2 the bank angle of the desired heading, and start the level-off when the altitude is within 1/10 the rate of climb of the desired altitude.

Figure 2-5. Climbing Left Turn



This aircraft is in the middle of a constant rate, climbing, standard rate turn.

Now try climbing from 4000 to 5000 feet at 500 feet per minute in a standard-rate left turn, finishing at the heading with which you began the turn. In other words, make a spiraling climb.

If you do this just right, you'll reach 5000 feet as you roll out at your initial heading.

Descend to 2000 feet at 1000 feet per minute while turning toward the departure airport. Land and proceed to Chapter 3.

Chapter 3

Navigation Charts

Chapter 3

Navigation Charts

En route and instrument approach procedure charts are vital to successful instrument flying in Flight Simulator.

Before you take off, it's always a good idea to know where you're going. That's especially true when you're flying on instruments, for without some navigational references, you'll quickly get lost. Fortunately, aeronautical navigation charts are available.

Such charts are published by the National Ocean Service, a division of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Some non-government publishers also produce and sell aeronautical charts.

The charts of primary concern to the instrument-rated single-engine airplane pilot are *en route low-altitude charts* and *instrument approach procedure* charts.

En Route Low-Altitude Charts

En route low-altitude charts provide information found on the charts included in the *Flight Simulator* owner's manual (VORs, NDBs, and airports, for instance). En route low-altitude charts also show *victor airways,* the highways in the sky used for airplane navigation.

Victor airways are nothing more than VOR radials. However, maximum and minimum altitudes are listed to insure that the airplane is at least 1000 feet above the highest obstacle along the route, and at an altitude that allows the airplane to receive the VOR signals. Unfortunately, the design of *Flight Simulator* makes en route low-altitude charts virtually unusable.

The transmission distance of a real VOR is often not duplicated on *Flight Simulator,* so that using the victor airways on the charts often does not work. Additionally, many of the VORs printed on the en route low-altitude charts aren't included in the *Flight Simulator* database.

That's why I recommend en route navigation be done using the charts included in the *Flight Simulator* owner's manual. These charts also appear, courtesy of SubLOGIC Corporation, in Appendix C of this book.

Using these en route charts may require some experimentation, and occasionally will result in a crash if the terrain is higher than you had anticipated. Generally, however, if you climb 5000 feet above the elevation of your departure or arrival airport, you can safely fly the route.

The Federal Aviation Regulations require that the airplane be operated at least "1,000 feet above the highest obstacle within a horizontal distance of five statute miles from the course to be flown." To comply with that regulation in *Flight Simulator,* you'll have to know the height of the highest obstacle within five statute miles of your path—a fact you're not likely to know. If you do know the height of the highest obstacle, however (maybe you're flying in a familiar area), you can choose your altitude accordingly.

Instrument Approach Procedure Charts

Instrument approach procedure (IAP) charts are the other important navigational aid for instrument-rated pilots. The IAP charts show the information you need to approach and land at an airport while flying on instruments.

IAP charts are published in bound regional volumes and distributed every 56 days. Twenty-eight days after they're released, a change notice is distributed. This change notice includes a new chart for each IAP that's altered or has been added since the previous round of publication. Pilots are told of notices to airmen (NOTAMs)—which include the most recent chart changes—when they get their weather briefing, done either in person or over the telephone.

Because of the time-critical nature of IAP charts, it's vital that the charts reprinted in this book *not* be used for actual navigation. They will have expired long before this book is sold.

There are three primary types of instrument approach procedures—VOR, NDB, and ILS approaches. These will be discussed completely in Chapters 5–7.

In recent years, new types of approaches have been developed, including area navigation and microwave. These new types of approaches can't be used on *Flight Simulator*. In fact,

most single-engine airplanes aren't equipped to use these approach methods.

Like the en route low-altitude charts, many of the IAP charts include some navigation aids which are not part of the *Flight Simulator* database. However, all IAPs reprinted in this book can be flown using *some* version of *Flight Simulator.*

Some versions of the program (Commodore, Atari, IBM, and Apple II) don't include the San Francisco database. The IBM version of *Flight Simulator* doesn't equip the airplane with an automatic direction finder (ADF). An ADF is necessary to use any of the NDB approaches. If your version of *Flight Simulator* doesn't include an ADF, you can't use the NDB approaches. There's also a restriction when you're using the Macintosh version of *Flight Simulator*—the ADF on the Macintosh isn't accurate. See Chapter 6 for details.

Around an IAP Chart

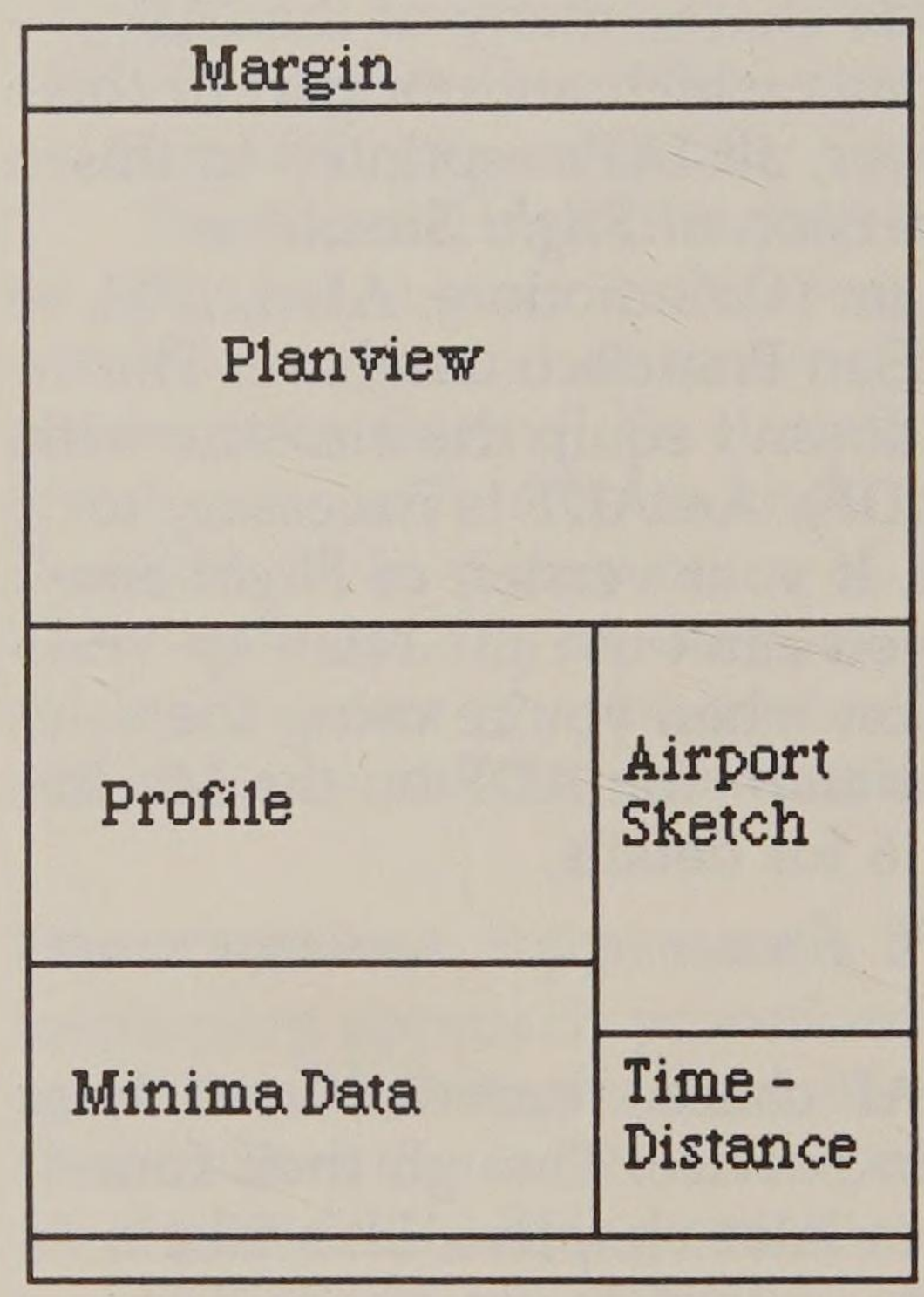
Appendix B includes over 125 IAP charts, reprinted from those published by the National Ocean Service. Though their function is explained in great detail in later chapters, let's take a look at the form of an IAP chart.

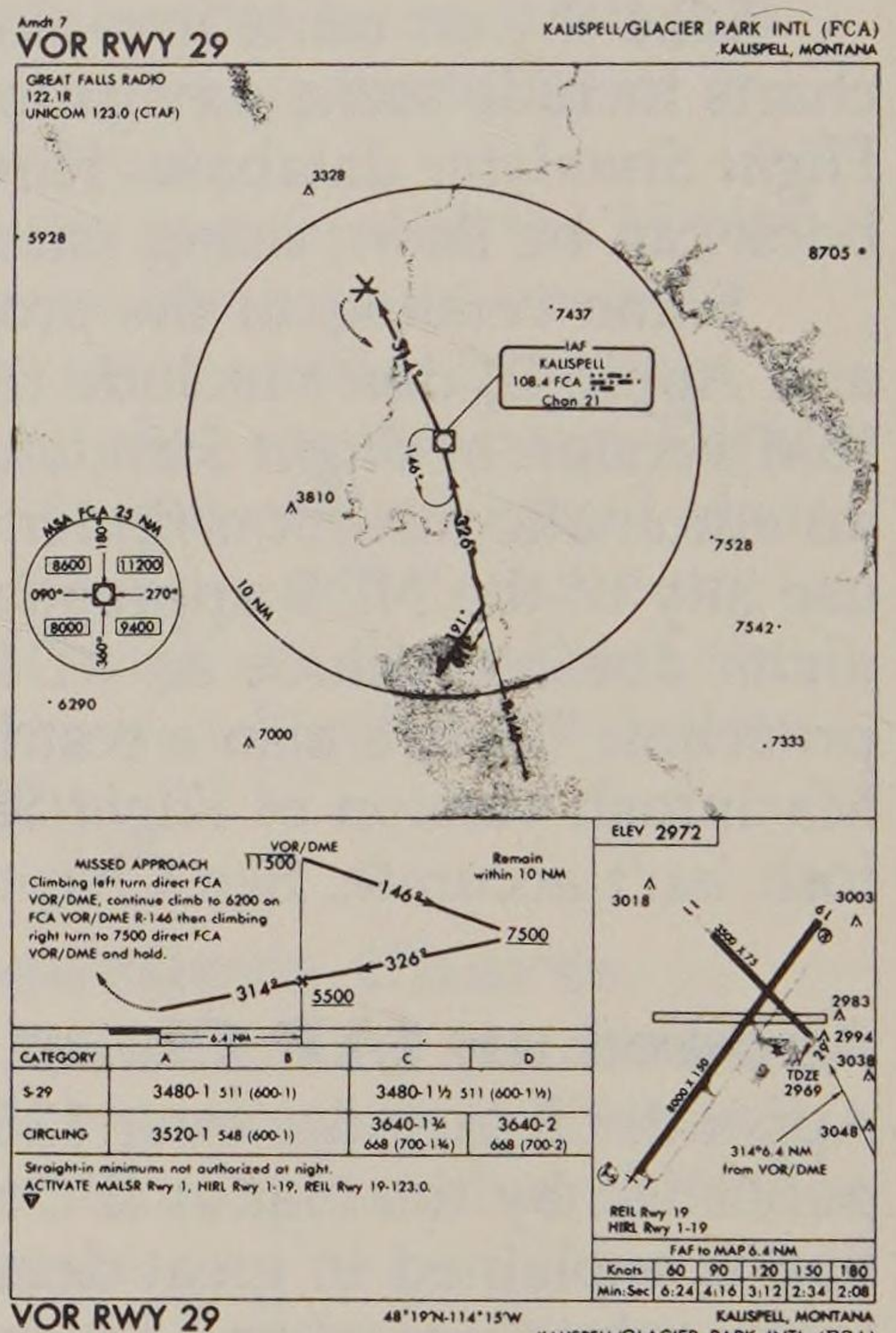
Margin. Information in the top and bottom margins provides the type of IAP (VORs, for instance), the runway or runways served by the IAP, the city and state of the airport, and the airport's name (which is in print larger than the city and state).

Planview. The planview depicts the navigation aids which are used to arrive at and conduct the instrument approach, including the procedure you should follow if you can't make a landing (called a *missed approach procedure*). The planview shows courses to be flown, communication frequencies, and other details. Most IAP charts include a solid ring which bounds the area within ten nautical miles of the facility on which the approach is based (the VOR for a VOR IAP, for example). If a dashed ring appears outside the ten-nautical-mile ring, only the area inside the solid ring is drawn to scale.

Profile. The profile depicts minimum, maximum, and mandatory altitudes to be flown for various segments of the instrument approach procedure. If an altitude is underlined, it's a minimum altitude. If the altitude is overlined, it's a maximum altitude. If the altitude is underlined *and* overlined, it's a mandatory altitude.

Figure 3-1. Instrument Approach Procedure Chart





An IAP chart is divided into six sections, each of which provides the instrument-rated pilot with different information.

Airport Sketch. The airport sketch displays the runway pattern, runway numbers, lengths and widths of the runways, mean sea-level elevation of the airport, and lighting associated with each runway.

Minima Data. This provides the minimum altitudes to which you may descend and the minimum visibilities in which the IAP may be executed.

Time-Distance. This section of the chart is used on IAPs where the final-approach facility (say a VOR on a VOR IAP) is some distance from the missed approach point. Times are provided for various groundspeeds so that the pilot knows when to execute the missed approach procedure.

Instrument approach procedure charts and legends are reprinted in Appendix B for use with *Flight Simulator*. Learning how to read and use IAP charts requires practice. You'll get that practice as you work through Chapters 5–7.

Chapter 4

Instrument Departures and En Route Procedures

Chapter 4

Instrument Departures and En Route Procedures

Begin flying on instruments as you travel from Chicago's Meigs airport to Chicago Heights. Use the NAV radios and the Omni-Bearing Indicator as you fly through the cloud cover.

Begin this chapter with the following settings to *Flight Simulator*:

Cloud base:	**1192**
North position:	**17189**
East position:	**16671**
Altitude:	**592**
Season:	**Winter**

(Sometimes when you manually set the altitude in Flight Simulator, *then exit the environment editor, you'll find your aircraft at a height approximately* twice *what you entered. If this happens, simply set the altitude to* 0*; then exit the editor. Your airplane will appear on the ground at the location you specified.)*

It's a cloudy wintery morning at Chicago's Merrill C. Meigs airport. Snow is beginning to fall, and the clouds are only 600 feet above the ground. Your airplane is warmed up and ready to begin the journey from Meigs to Champaign, Illinois, with intermediate stops at Kankakee and Dwight.

Getting Clearance

Before taking off, you're required by the Federal Aviation Regulations to file a flight plan and receive clearance from air traffic control. Since *Flight Simulator* doesn't perform this function, make up your own clearance for the planned flight.

A typical clearance includes the following information:

- **A clearance limit.** Typically—and for *Flight Simulator* purposes, always—the destination airport.
- **A departure procedure.** The heading and altitude at which to depart the airport.
- **Route of flight.** The route to the destination airport. For simulation purposes, the flight route is defined by the names of VORs or NDBs along the flight path.
- **Altitude data.** The altitude to be flown along the route.

For the first leg of this morning's flight, your clearance is:

Cleared to the Greater Kankakee Airport via direct Chicago Heights direct Peotone direct, climb and maintain 6,000.

Before you take off, look at the IAP chart for Chicago/Lansing Municipal Airport, found in Appendix B on page 139.

See the white *T* in the black upside-down triangle near the bottom of the chart? This symbol means that there's a published departure procedure for this airport. (You'll find the departure procedure in Appendix A, under *Chicago, IL: Lansing Muni*.)

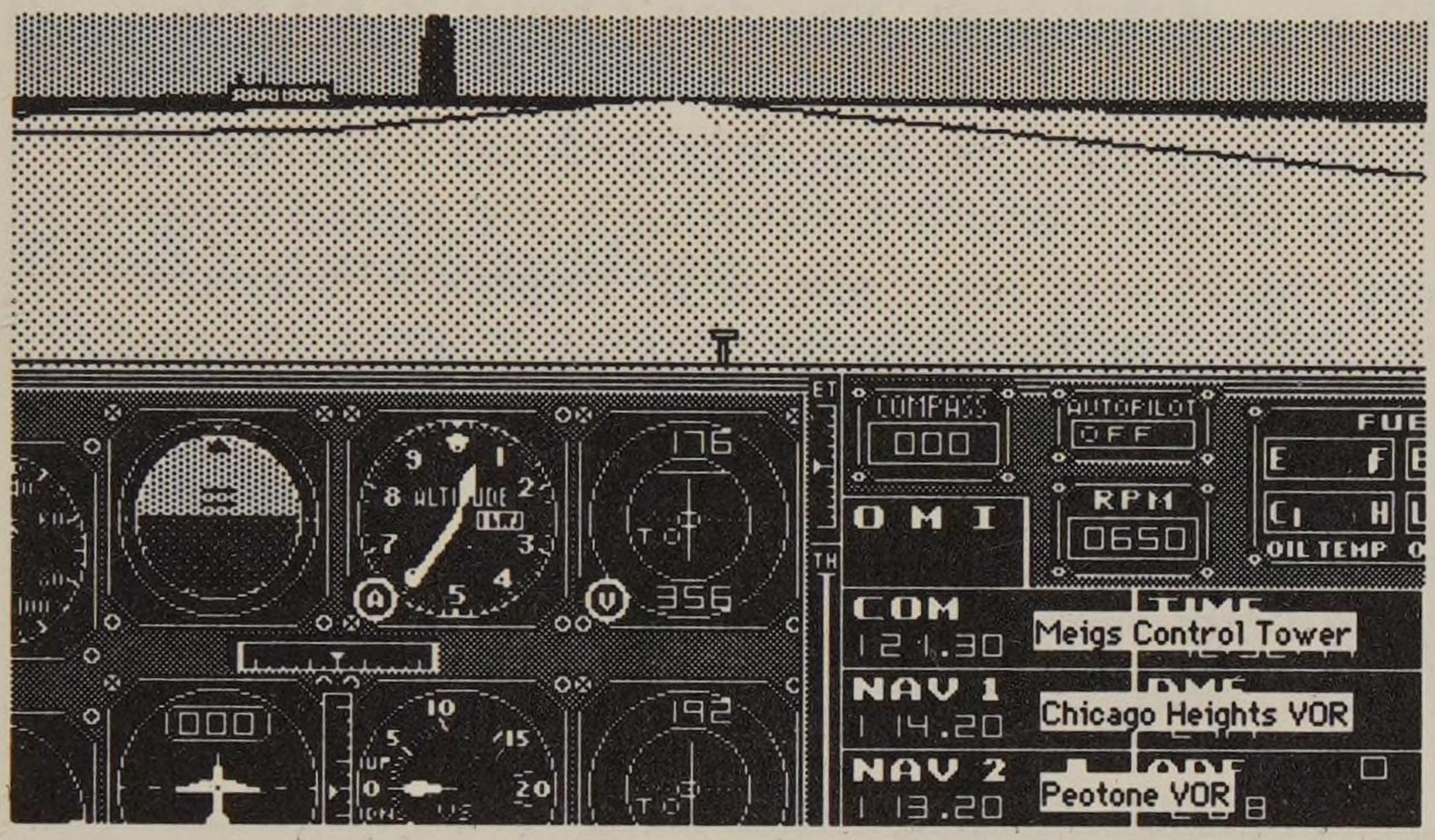
Now look at the IAP chart for Chicago/Merrill C. Meigs Airport. It's on page 140 of Appendix B. Note that the *T*-triangle symbol doesn't appear there. That indicates there's no published departure procedure for Merrill C. Meigs Airport. Where there's no published departure procedure, you must use good judgment in avoiding obstructions during takeoff.

Pre-Takeoff Avionics

Since your clearance directs you to fly direct to the Chicago Heights VOR, tune your NAV-1 radio to 114.2. Rotate the Omni-Bearing Selector (OBS) until the TO/FROM indicator displays *TO* and the course deviation indicator needle is centered.

While you're on the ground, tune your NAV-2 radio to Peotone on 113.2 and center the needle with a *TO* indication. (This saves you time when you're in the air.) Tune in the control tower by setting the COM radio to 121.3; then "listen" to the airport information.

Figure 4-1. Pre-Takeoff Avionics Settings



Your instrument panel should show these settings for COM, NAV 1, and NAV 2.

Cloud Quirks

To use *Flight Simulator* for instrument flying, you must be aware of one of its quirks. When air traffic controllers advise pilots of the weather, any reference to cloud heights is given as *height above ground level.*

With *Flight Simulator,* however, references to cloud heights are to *height above sea level.* To program cloud heights, then, you must add the height at which you want the clouds to appear to the airport elevation. Enter that sum in the environment editor. Remember that control tower reports of cloud heights will refer to mean sea level heights.

If you took off from Merrill C. Meigs with your environment editor showing the base of the clouds at 600 feet, you'd be inside those clouds immediately after takeoff (since Meigs' altitude is 592 feet above sea level). To prevent this, set the cloud base to 1192 feet (the airport elevation plus 600).

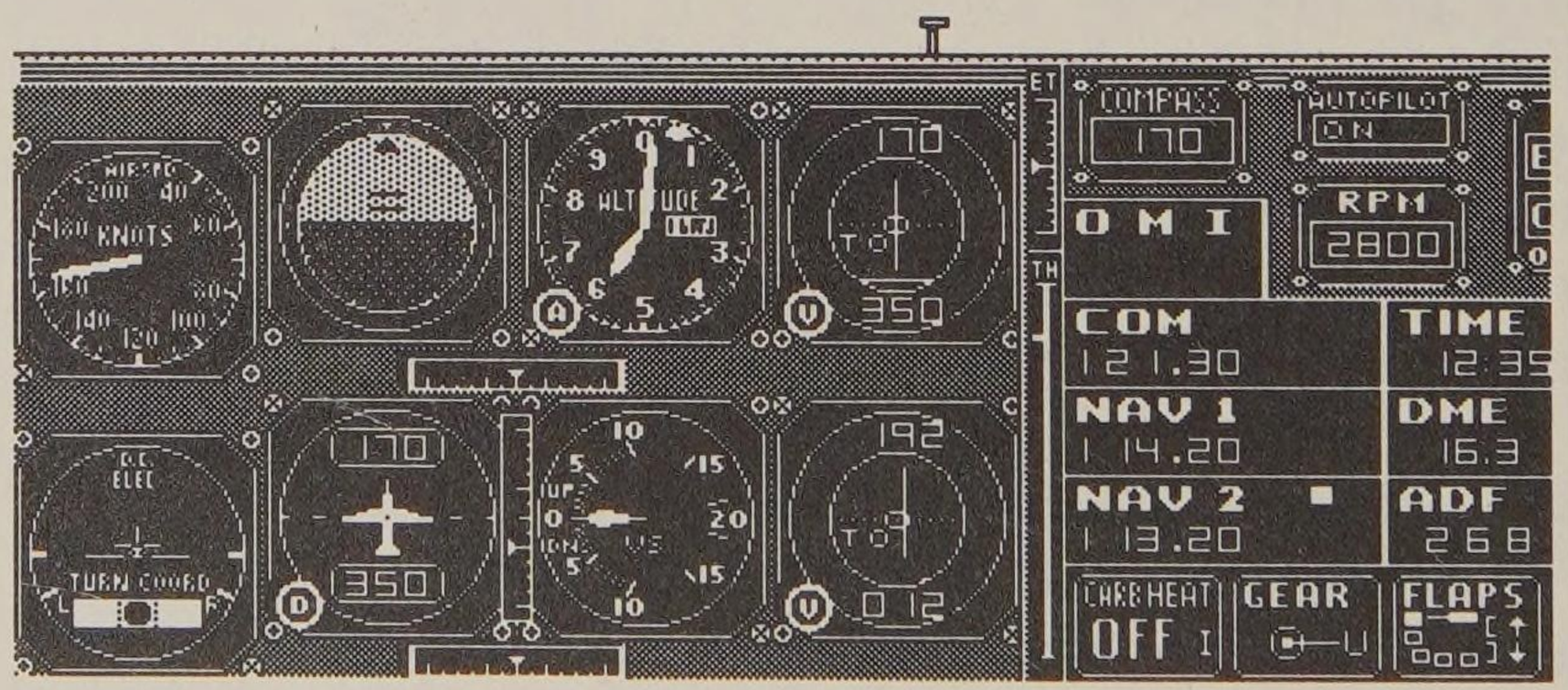
The flights in this chapter, and in the next three chapters, all use 1192 as a cloud base. You don't have to set the simulator's cloud tops if you don't want to. On some versions of *Flight Simulator*, setting only a cloud base has an important side effect—you'll fly through the cloud layer (it's not very thick) and once above it, there's a horizon line. This horizon can be especially helpful when you're just learning how to fly on instruments.

After you're more experienced, you may want to set cloud tops as well, so that you're flying in the midst of clouds during your entire flight. The view outside the aircraft should be completely white (or blank) when you're in clouds.

Takeoff

When you're ready, take off from Meigs. As you climb, bank right and turn to the heading shown on the Omni-Bearing Indicator (OBI). It should be close to 170°.

Figure 4-2. Needle Recentered



Centering the needle on the Omni-Bearing Indicator shows the course to the VOR station tuned in with the NAV 1 radio.

Continue climbing until you reach 6000 feet.

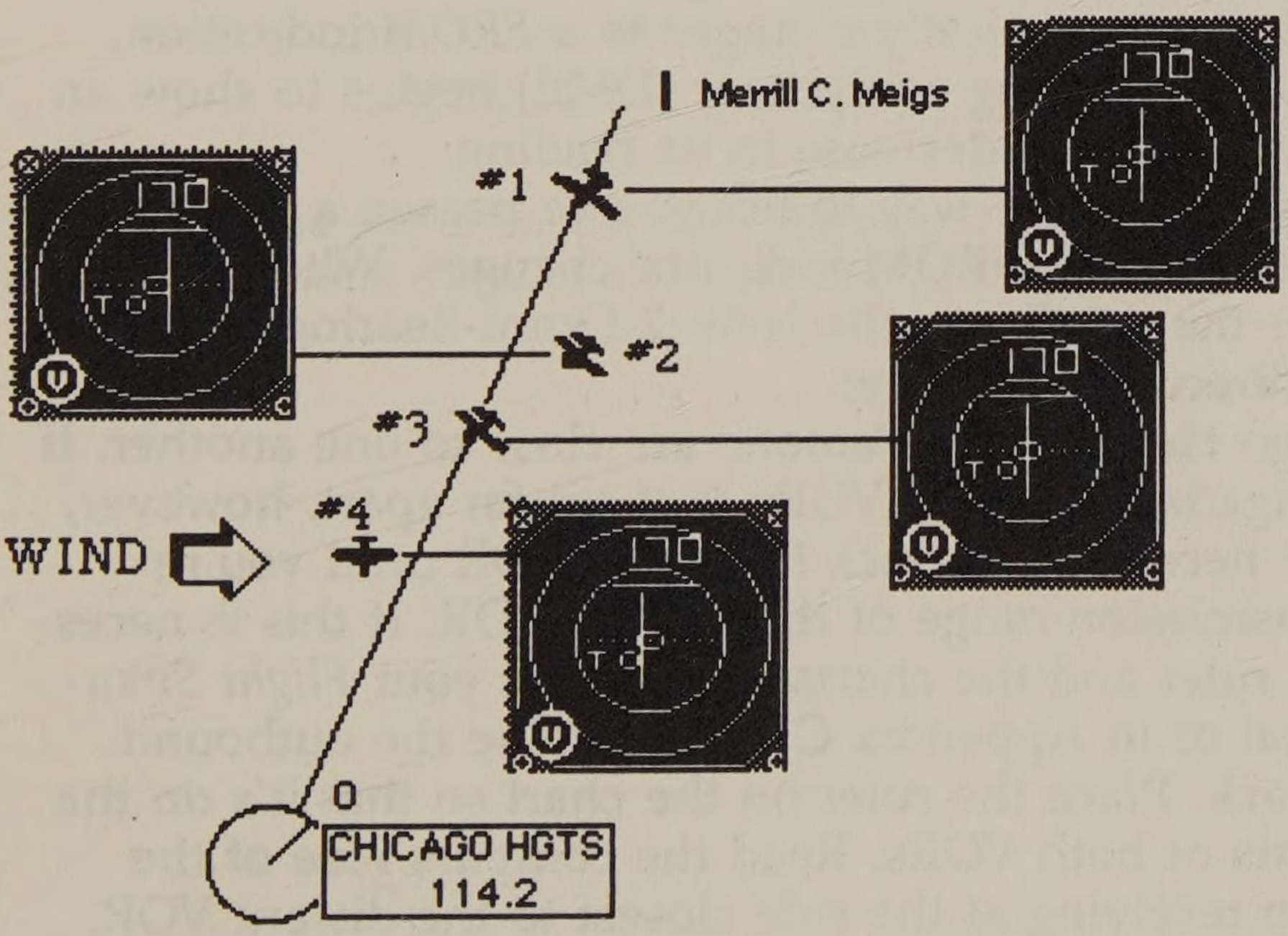
Reset the heading indicator to the magnetic compass when you level off at 6000 feet and are not accelerating. If the wind velocity is set to 0 in the environment editor, the needle

should remain centered while you hold the heading shown on the OBI. If the wind velocity is greater than 0, though, you should use this procedure to track the VOR radial with a correction for wind.

Wind Compensation

- When the needle moves one dot or more either side of center, turn the airplane 20° toward the needle (Figure 4-3, airplane #2). The needle represents the course, and course corrections are made *toward* the needle. Remember, however, that if you're flying *to* the VOR with a *FROM* indication, or *from* the VOR with a *TO* indication, corrections must be made away from the needle.
- Fly the new heading until the needle approaches the center once again (Figure 4-3, airplane #3). If the needle continues to move away from the center, turn another 10° toward the needle and repeat this procedure up to a maximum correction of 90°.

Figure 4-3. VOR Tracking with Wind



If wind is present in your simulation, you need to know how to conpensate for it as you fly on instruments.

- Take out one-half of the correction you used to recenter the needle (if you are tracking with the OBI set to 170°, and you turned 20° to the right to recenter the needle, turn left to heading 180° when the needle recenters). This establishes a correction angle of 10° to compensate for the wind's effect.
- If the needle stays centered, the wind correction angle is the proper amount of correction for the current wind conditions.
- If the needle begins to move to the opposite side, the wind correction angle is too great (see Figure 4-3, airplane #4). Turn the airplane so that its heading is the same as the Omni bearing selected, and when the needle recenters, turn so that you're using one-half of your previous wind correction angle.

The closer the airplane is to the VOR transmitter, the more sensitive the instrument becomes. When the airplane is within two miles of the transmitter, large needle deviations may occur. Don't chase the needle as it fluctuates when you're close to the transmitter.

Going On

As you pass over the Chicago Heights VOR transmitter, the *TO* indication automatically changes to a *FROM* indication. The distance-measuring equipment (DME) begins to show an increase rather than a decrease in its reading.

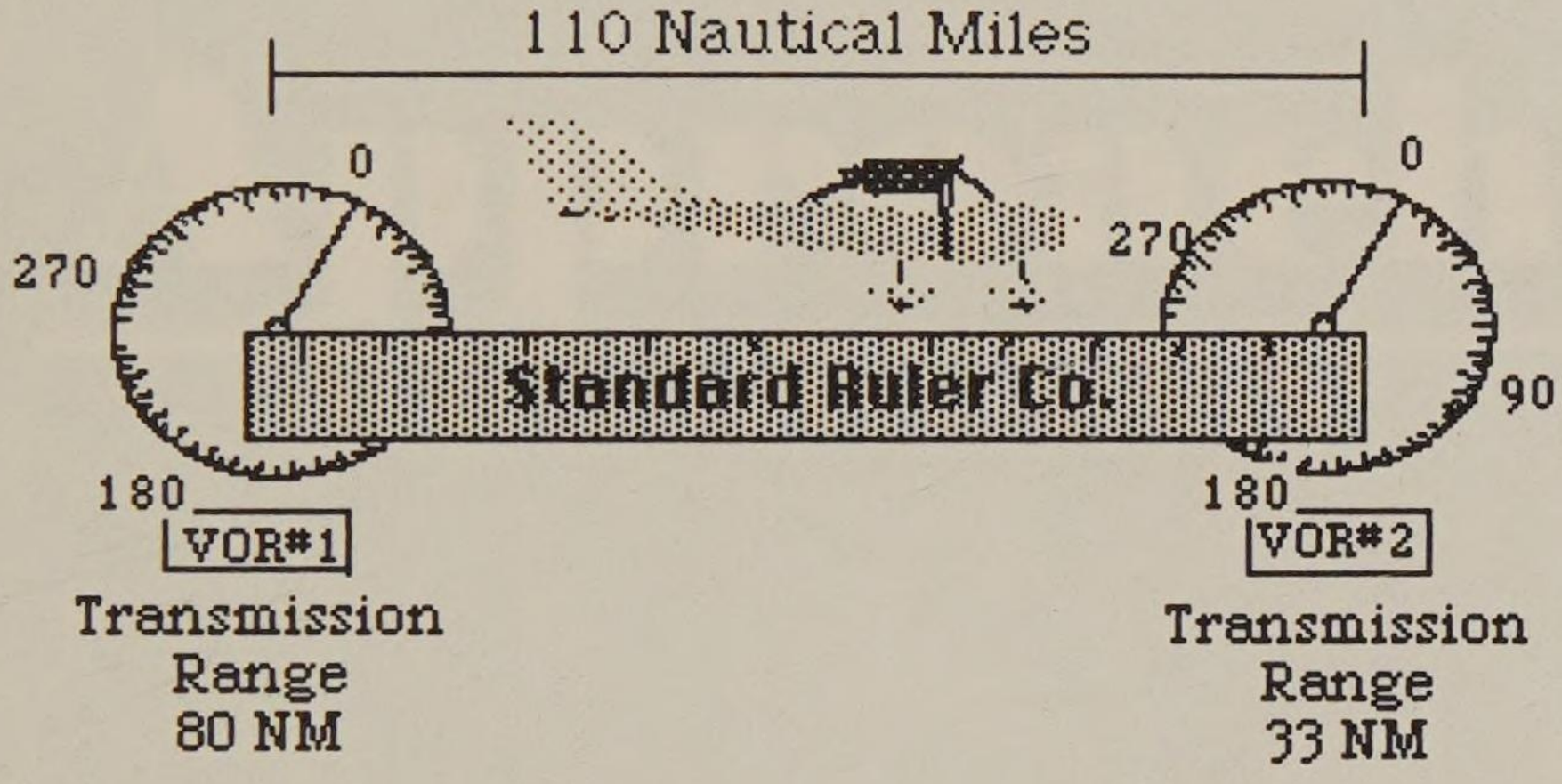
The most accurate way to tell you've passed a VOR station is when the TO/FROM indicator changes. When this occurs, center the needle on the NAV-2 Omni-Bearing Indicator and track directly to Peotone.

Chicago Heights and Peotone are close to one another. If you're navigating between VORs that are far apart, however, it might be necessary to track from one VOR until you're within transmission range of the second VOR. If this is necessary, use a ruler and the charts included in your *Flight Simulator* manual or in Appendix C to determine the outbound radial to track. Place the ruler on the chart so that it's on the center points of both VORs. Read the compass rose of the VOR you're receiving at the side closest to the distant VOR. The compass rose is graduated with 5° ticks. This is the radial that you should track outbound. Keep flying that radial (and that course if the VOR falls out of range) until you begin to receive the next VOR.

Now, turn the Omni-Bearing Selector (OBS) of the NAV-2 OBI until the needle is centered and a *TO* indication shows. Track that radial. (It should be close to what you read from the chart-and-ruler exercise.)

Figure 4-4 illustrates the procedure.

Figure 4-4. Flying Between Distant VORs



Eastbound: Track the 060 radial from
VOR #1 for 77NM
Westbound: Track the 240 radial from
VOR #2 for 30NM

Use a ruler and one of the en route charts to track from one VOR until you're within range of a second, distant VOR.

Chapter 5

VOR Approaches

Chapter 5

VOR Approaches

Tackle your first instrument approach procedure as you use VOR radials to guide you to Kankakee.

You've just passed over the Chicago Heights VOR at 6000 feet. Your NAV-2 Omni-Bearing Selector (OBS) should be set to approximately 216° with a *TO* indication to guide you directly to the Peotone VOR. While the airplane is flying toward Peotone, tune 111.6, the Kankakee VOR frequency, into NAV-1. Until you get within a few miles of Peotone, the Kankakee VOR will be out of range.

Note: The database on at least one early version of *Flight Simulator* was missing the Kankakee VOR.

If, by the time you pass the Peotone VOR (as shown by the *FROM* indication), you've not been able to receive the Kankakee VOR, use the Chicago Heights VOR instead of Kankakee. Read through this chapter, but substitute the Chicago Heights VOR for all instances of the Kankakee VOR.

Proceed directly to Chicago Heights while descending to 2300 feet. You'll not be able to use the Peotone VOR to identify the AROMA intersection. Instead, substitute 4.8 DME for AROMA. When you complete the approach (there won't be an airport in sight), pause the simulation and begin Chapter 6.

Descending Time

It's time to start thinking about a descent. Tune in the Greater Kankakee control tower on 123.0 to find out which runway is in use. The control tower reported runway 22 in use when I made the flight. Look in Appendix B, page 169, for the VOR RWY 22 approach to Greater Kankakee.

See the short, thin line extending from Peotone toward the Kankakee VOR in the planview? That line is called a *terminal route* and indicates that you can descend to 2300 feet

and follow the 191° radial for 12 nautical miles to the Kankakee VOR. *Flight Simulator* only provides even-numbered radials, so use 190° or 192°. (The Atari ST and Commodore Amiga versions of *Flight Simulator* are exceptions to this last statement. You can set the OBI to any radial. If you're using one of these versions, you can use the actual radial described, not just an even-numbered one.)

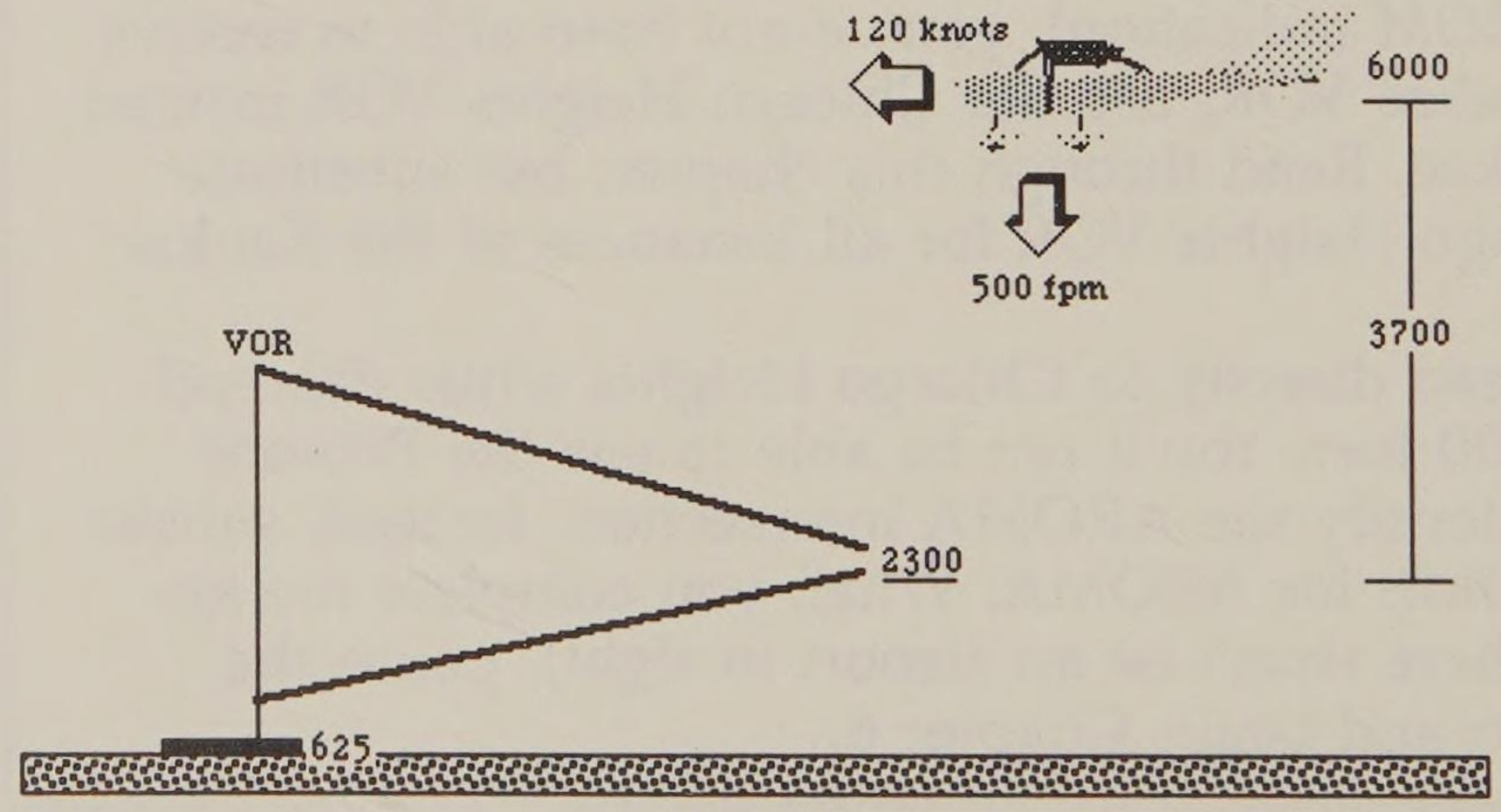
But you're at (or should be at) 6000 feet now. Time to start down.

To calculate how many miles in advance you should begin your descent, use this formula:

groundspeed/60 * (feet to descend/rate of descent) = miles

In this case, if your groundspeed is 120 knots and you want to descend at 500 feet per minute, you'll need 14.8 nautical miles (120/60 * (3700/500) =14.8).

Figure 5-1. Descending



To descend from 6000 to 2300 feet at a rate of 500 feet per minute while flying with a groundspeed of 120 knots, you need to begin the descent about 14.8 miles from the Kankakee VOR.

Don't worry if you're not down to 2300 feet by the time you reach the Kankakee VOR. You can fly at least another ten nautical miles after reaching the VOR before a descent below 2300 feet is authorized. However, if you want to minimize the time required to fly the approach, you won't want to be very high above the minimum altitude when you cross the VOR.

If you find that you don't have enough distance remaining to make your descent at 500 feet per minute, you can compute the necessary rate of descent using this second formula:

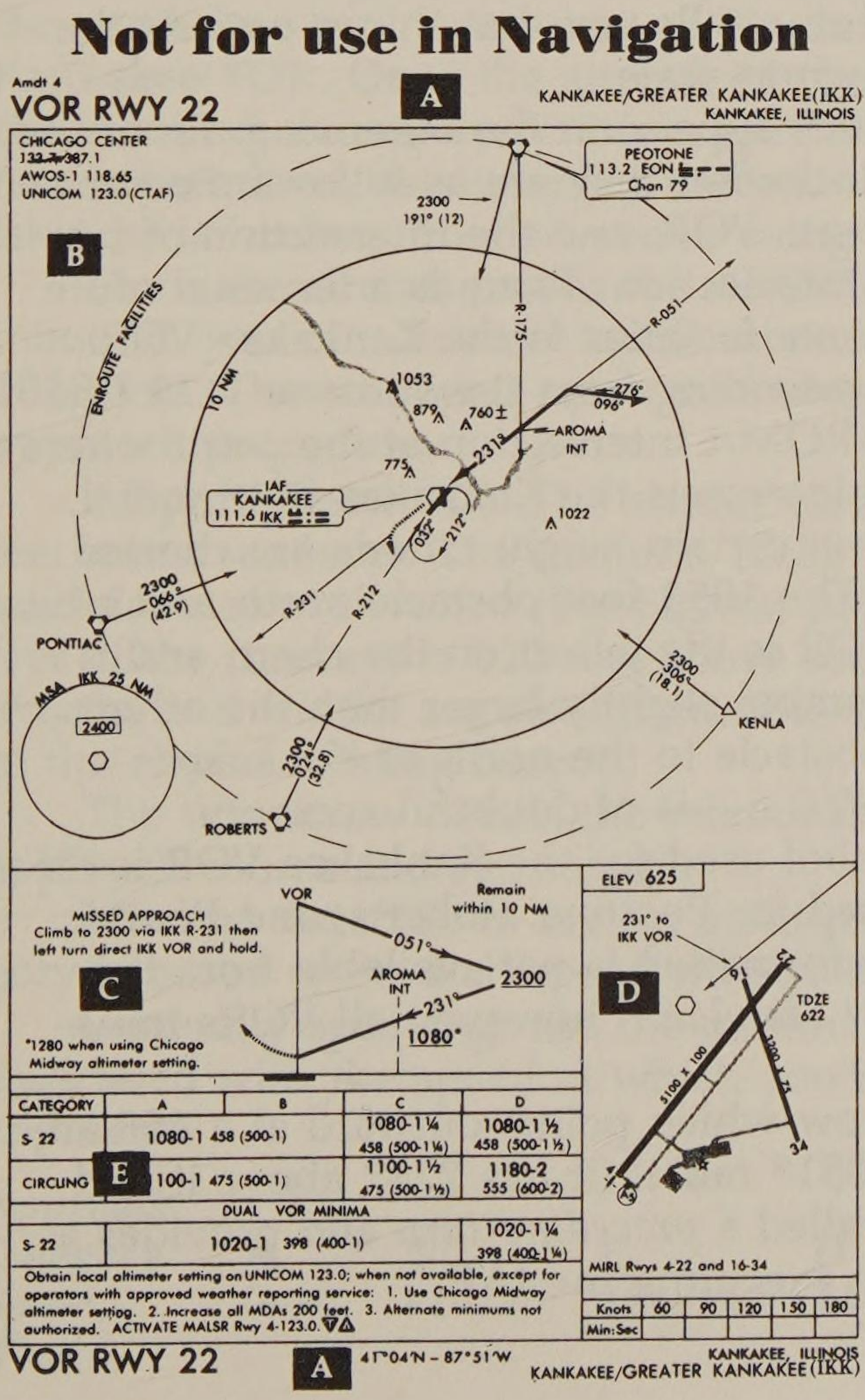
feet to descend * (groundspeed/(60 * miles)) = required rate of descent

After crossing the Peotone VOR, establish yourself on the radial (190° or 192°), pause the simulation, and familiarize yourself with the Kankakee VOR RWY 22 IAP chart.

The Kankakee IAP

Take a look at this reduced version of the VOR RWY 22 IAP chart for Kankakee.

Figure 5-2. Kankakee



Margins (A). These tell you that this is the VOR RWY 22 IAP to Greater Kankakee Airport in Kankakee, Illinois. The latitude and longitude at the bottom center are provided for aircraft with inertial navigation systems.

The amendment number in the upper left-hand margin identifies how many times the IAP has been amended since it was first published. In this case—*Amdt 4*—the IAP has been amended four times.

Planview (B). The upper left corner of the planview contains communication frequencies used by aircraft landing at Kankakee. Frequency 123.0, labeled UNICOM, is available for traffic advisories.

The solid ring labeled *10 NM* bounds the area ten nautical miles around the Kankakee VOR. Everything inside this ring is drawn to scale. Note that certain topographical features—the river, for instance—appear only inside this ring. The dashed ring outside the 10-NM ring tells you that things outside the 10-NM ring are not drawn to scale.

Four en route facilities appear on the outer ring. From the top and going counterclockwise, they are as follows: Peotone VOR, Pontiac VOR, Roberts VOR, and the intersection of two VOR radials at KENLA intersection. There is a terminal route from each of these en route facilities to the Kankakee VOR.

The second radial, extending from the Peotone VOR (the 175° radial) identifies AROMA intersection at the point where the Peotone 175° radial intersects the Kankakee 051° radial.

Obstacles which meet certain height criteria are charted inside the 10-NM ring. The 1053-foot obstacle north and a bit west of the Kankakee VOR is the tallest on the chart, and is shown by an obstacle symbol slightly larger than the others.

The height of the obstacle to the north of Kankakee VOR—the one marked 760 ± —is of doubtful accuracy.

Notice that the symbol used for the Kankakee VOR is different from the three used for Peotone, Roberts, and Pontiac. This means that DME information is *not* available from the Kankakee VOR. In *Flight Simulator*, however, all VORs transmit distance information.

Find the barbed arrow which points outward at a 45° angle from the Kankakee 051° radial (it has 276° above it and 096° below it). This is called a *procedure turn* and provides a way to reverse course in executing the IAP.

The scalloped arrow extending from the Kankakee 231° radial and the racetrack-shaped holding pattern (both near the airport symbol) show the missed approach procedure you'd use if you couldn't make a landing.

The final item on the planview is the Minimum Safe Altitude (MSA) circle in the lower left corner. The MSA will show an altitude or altitudes which assure the pilot of at least 1000 feet of vertical obstacle clearance within 25 nautical miles of the VOR or NDB on which the IAP is based. Here, an altitude of 2400 feet assures the pilot of at least 1000 feet between that altitude and the tallest obstacle within 25 nautical miles of the Kankakee VOR. The MSA is to be used for emergencies only.

Profile (C). The underlined *2300* indicates that an aircraft executing the approach can descend to a minimum altitude of 2300 feet while established on the Kankakee 051° radial. The notation *Remain within 10 NM* restricts the outbound leg and the procedure turn to an area within ten nautical miles of the Kankakee VOR. Once the aircraft has become established on the inbound course, descent to a minimum altitude of 1080 feet is permitted, as shown by the underlined *1080*. (The asterisk note is irrelevant when you're using *Flight Simulator*.)

Once the aircraft passes the AROMA intersection while inbound, you can descend to the minimum descent altitude—1020 feet. The scalloped arrow and text provide the missed approach procedure.

Airport sketch (D). The airport elevation is listed as 625 feet mean sea level. The notation *TDZE 622* means that the *touchdown zone elevation* (the highest point in the first 3000 feet of the runway) is 622 feet above sea level. Runway lengths and widths are also listed. The star shows the position of the airport rotating beacon.

The thin arrow details the relationship between the final approach course and runway 22.

Minima data (E). In reality, an airplane's approach category is based on its stall speed when it's getting ready to land.

Generally speaking, use the minima category below that's associated with the speed at which you're flying the final approach.

Approach Category	**A**	**B**	**C**	**D**
Speed (Knots)	0–90	91–120	121–140	141–165

Thus if you fly the final approach at 100 knots, use the minima set for category B.

S-22 minima are for straight-in approaches (the VOR RWY 22 IAP is executed and landing is planned on runway 22). If the VOR RWY 22 IAP is made with a landing planned on another runway, then the *Circling* minima should be used.

If a straight-in approach is planned with a final approach speed of 100 knots and using both VOR receivers, the applicable minima are a minimum descent altitude (MDA) of 1020 feet and a minimum visibility of one mile (*1020-1*).

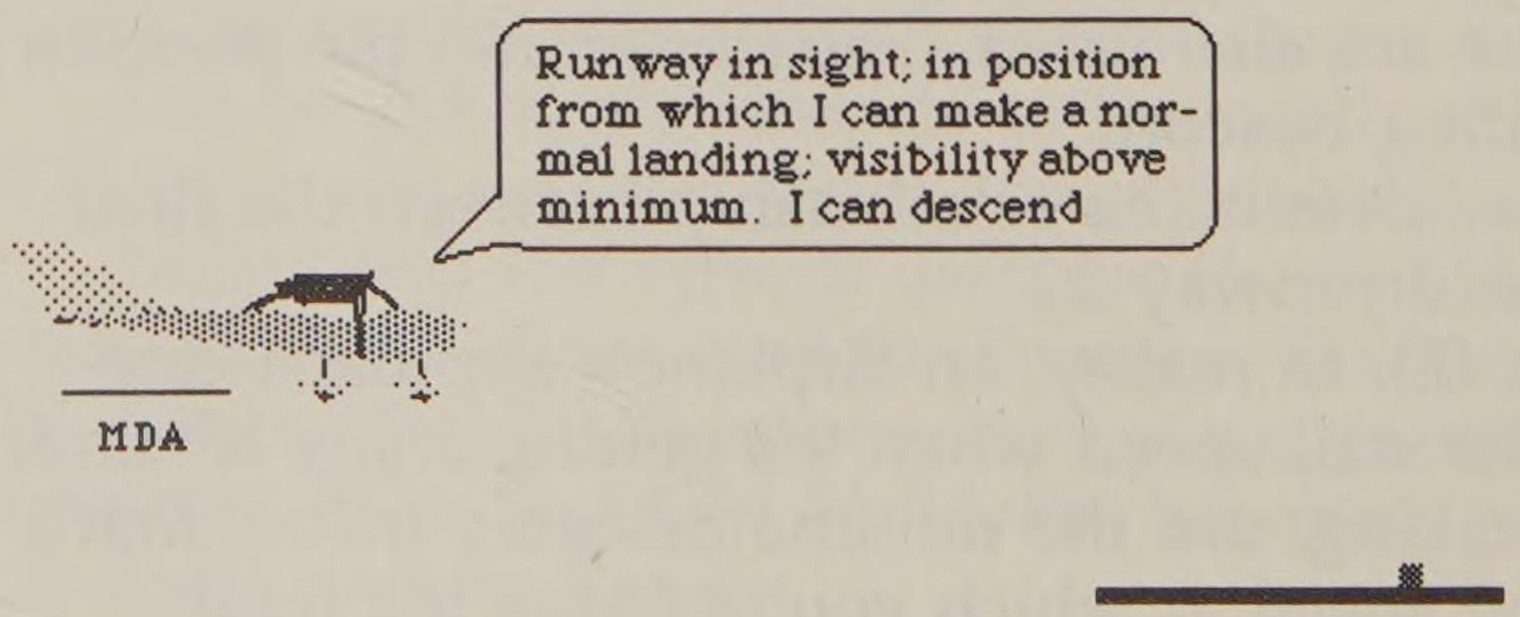
The *398* is the *height above touchdown* (HAT) when you're at the MDA. The *475* shown in the same location for the Circling approach is the *height above airport* (HAA). The difference between the two numbers is that one (HAT) is referenced to the touchdown zone elevation (the highest point in the first 3000 feet of the runway). The other (HAA) is referenced to the airport elevation.

The figures inside parentheses are for military use only.

Note that a lower MDA is allowed when the airplane is equipped with two VOR receivers—that's because the AROMA intersection can be identified.

If you look at either the planview or the profile for the VOR RWY 22 IAP, you will see that the VOR is located on the airport. This IAP is called a *terminal VOR approach*. When you execute a terminal VOR approach, use the missed approach procedure when the airplane is *over* the VOR.

Figure 5-3. Go Ahead and Descend



Every condition must be met before a landing can be undertaken.

Federal Aviation Regulations prohibit descent below the minimum descent altitude unless the airplane is "continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers..., the flight visibility is not less than the visibility prescribed in the standard instrument approach procedure being used," and the pilot distinctly sees the runway of intended landing (or specified lights or markings associated with that runway). If any of these conditions aren't met, the pilot is required to execute the missed approach procedure.

Shoot the Procedure

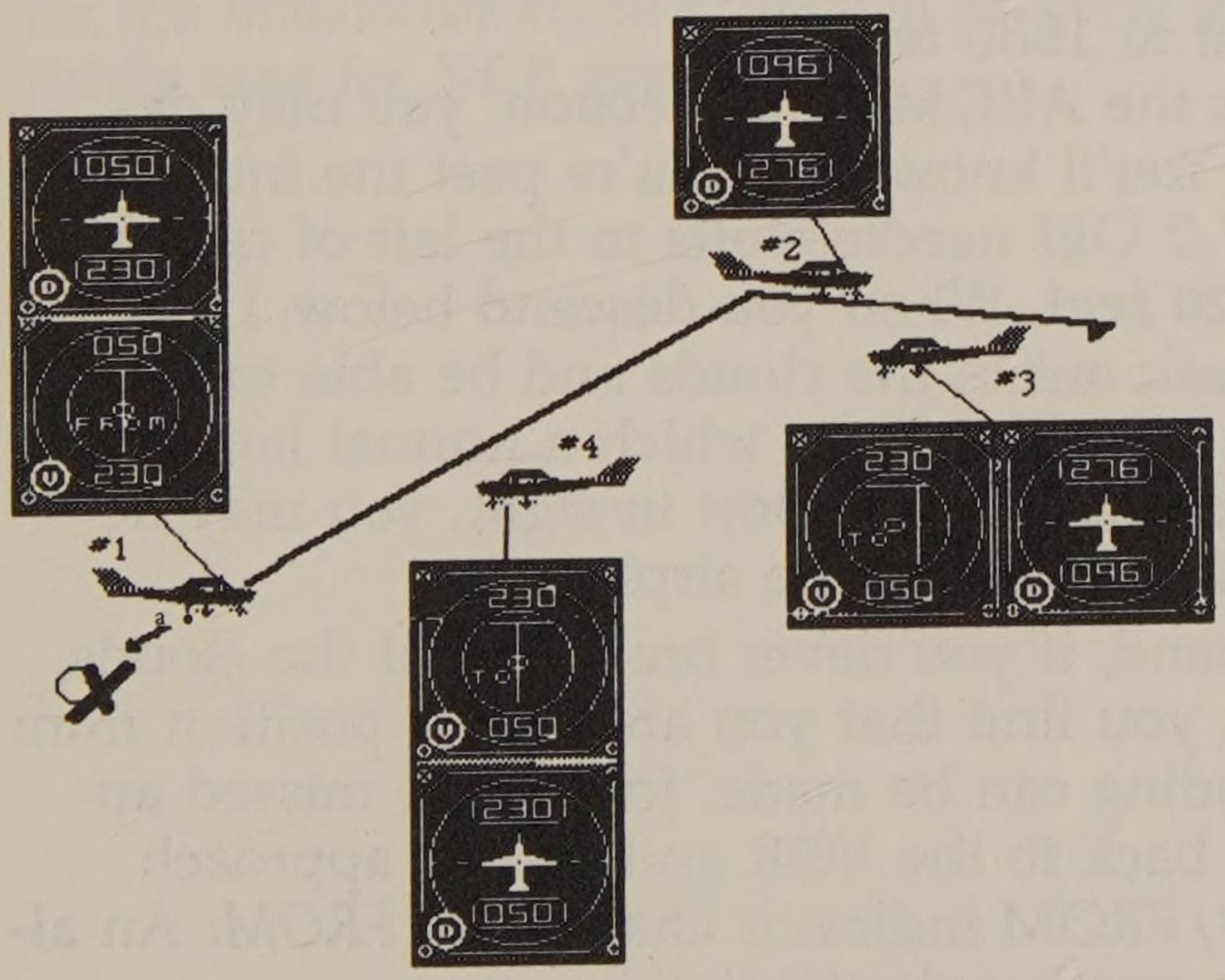
Unpause *Flight Simulator* now and give the VOR RWY 22 IAP a try.

All IAPs begin at an initial approach fix (IAF), except for those where the aircraft must be given headings by an air traffic controller (called radar vectors) to intercept the final approach course. The VOR RWY 22 approach has only one IAF. Some approaches have many.

The VOR is the IAF for the VOR RWY 22 IAP. Notice that *IAF* is printed above the nav-aid box in the planview (to the left of the Kankakee VOR symbol).

Follow these instructions, using Figure 5-4 as a guide.

Figure 5-4. Shooting the Procedure



This illustration outlines the turns and OBI course indications for flying the VOR RWY 22 approach at Kankakee.

To VOR, turn and establish on 51° radial. Fly over the VOR; then make a left turn and fly away from the airport on the 051° radial, as shown in both the planview and the profile view. Since *Flight Simulator* provides even-numbered radials in most versions (exceptions are the Atari ST and Commodore Amiga versions), you'll have to modify the approach by flying either the 050° or 052° radial. Fly outbound from the VOR with a *FROM* indication and the OBS set to 050° (Figure 5-4, airplane #1). Fly far enough to give yourself room to reestablish yourself on the inbound course and descend to 1080 feet, but in no case fly more than ten nautical miles from the VOR. While you're doing this, reduce your speed to approach speed (90–110 knots in most single-engine airplanes).

Procedure turn. Try beginning the procedure turn when you're five miles from the VOR. Turn right to 096° and fly that heading for one minute (Figure 5-4, airplane #2). Reset the NAV-1 OBI to the inbound radial (either 230° or 232°), and set the NAV-2 OBI to 174° or 176° so that you'll be able to identify the AROMA intersection.

Turn left to 276°. After one minute, turn left to 276°, and fly that heading until the NAV-1 needle approaches the center (Figure 5-4, airplane #3).

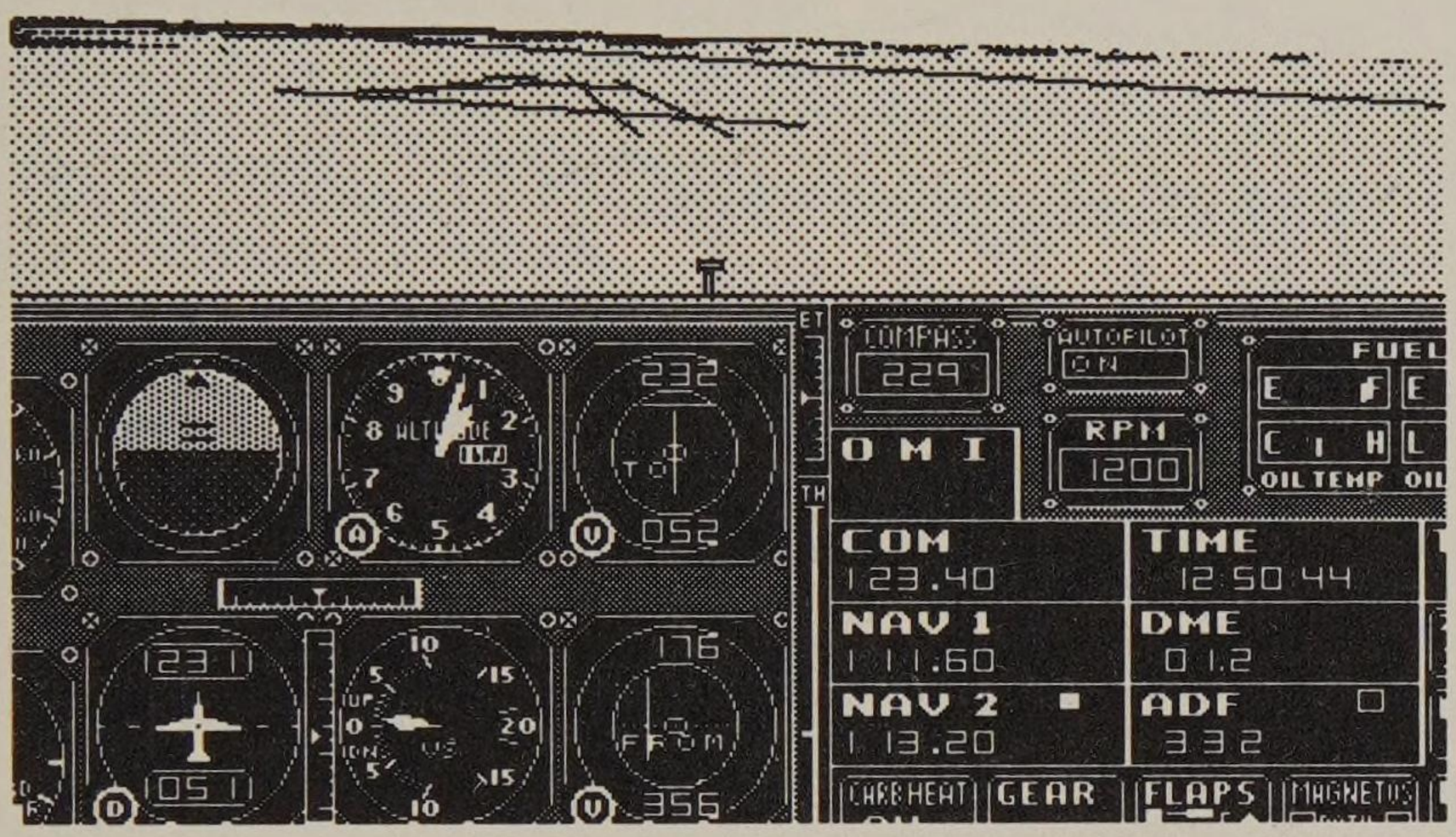
Turn to inbound course of 231°. When the NAV-1 needle approaches center, turn to the inbound course of 231° and track the VOR inbound (Figure 5-4, airplane #4). Once the needle is centered and you're established on the inbound radial, begin a descent to 1080 feet.

When you pass the AROMA intersection, you may descend to 1020 feet. You'll know that you're past the intersection when the NAV-2 OBI needle shifts to the left of center.

Descend to 1020 feet. When you descend below 1192 feet, you should break out of the clouds and be able to see the airport. If you're in a position from which a normal landing can be made and you have the airport in sight, you may descend below the MDA and land the airplane.

On the other hand, if you never break out of the clouds, or if, when you do, you find that you aren't in a position from which a normal landing can be made, follow the missed approach instructions back to the VOR and try the approach again when the TO/FROM indicator changes to *FROM*. An alternative is to fly to another destination.

Figure 5-5. Land It



You're past the AROMA intersection (as shown by the needle left-of-center on the NAV-2 OBI), at an altitude of 1020 feet, and have the airport in sight. Land the airplane.

If you want to practice more VOR approaches before trying other types of approaches, skip ahead to Chapter 8. If you're ready to try NDB approaches, move on to Chapter 6. If your version of *Flight Simulator* is not equipped with an ADF, read Chapter 6 before proceeding to Chapter 7 and begin Chapter 7 after positioning your airplane at Dwight Airport.

Note: The ADF on version 1.0 of Microsoft Flight Simulator *for the Macintosh doesn't function properly and cannot be accurately used for NDB approaches.*

Chapter 6

NDB Approaches

Chapter 6

NDB Approaches

Fly to airports using the automatic direction finder (ADF) and nondirectional beacons (NDB). Take off from Kankakee and make for Dwight.

Begin this chapter with the following settings to *Flight Simulator*:

Cloud base	**1192**
North position	**16846**
East position	**16597**
Altitude	**625**
Season	**Winter**

Assuming everything went right during your approach and landing at Greater Kankakee, you're now safe and sound on the ground, near the fueling area. The weather hasn't changed since you left Chicago, but it's time to begin the next leg of your trip to Dwight, Illinois.

Unlike Chicago Meigs Airport, there's a *T* in an upside-down triangle in the bottom margin of each of the Greater Kankakee IAP charts. Earlier, you learned this symbol means there is a published departure procedure for the airport. In fact, the *T* means that either there's a published departure procedure or that the minimum weather conditions for takeoff are nonstandard. Takeoff-weather minima, however, apply only to commercial aircraft operators.

The standard takeoff minima are one statute mile visibility for aircraft with two engines or less, and one-half statute mile visibility for aircraft with three engines or more.

If you look under *Kankakee* in Appendix A, you'll find only a nonstandard takeoff minimum listed. For commercial operators which operate under Federal Aviation Regulations (FAR) Part 135, the takeoff minimum on runway 4 is reduced for single- and twin-engine aircraft to one-half mile.

This doesn't apply to your flight, for two reasons. First, you'll depart on runway 22, the same runway you landed on.

Second, unless today's fantasy trip includes being a Part 135 commercial operator, the nonstandard minimum has no application to your flight.

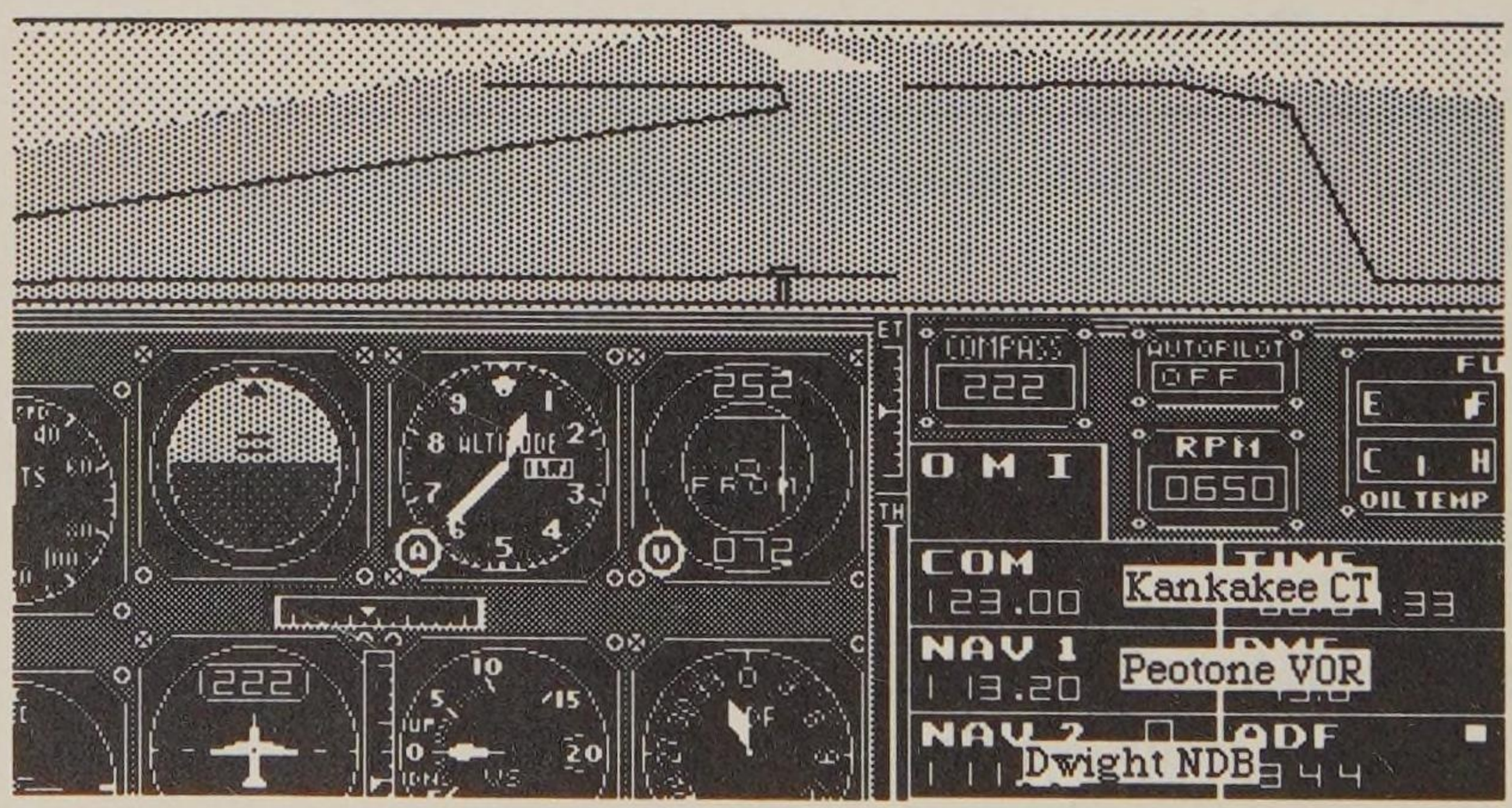
Pre-Flight

Before you take off from Kankakee, turn to page 152 of Appendix B—the NDB RWY 27 IAP chart for Dwight. Notice that there's a terminal route from the Peotone VOR to the Dwight nondirectional beacon (NDB). The terminal route is the Peotone 253° radial at 2300 feet. Your clearance for this flight might be something like

Cleared to the Dwight Airport via the Peotone two-five-three radial, climb and maintain 2,300.

Set up your aircraft for departure by tuning the NAV-1 radio to the Peotone VOR, the ADF to Dwight's NDB frequency, and the COM radio to the Kankakee CT. Figure 6-1 shows you what your instruments should read.

Figure 6-1. Pre-Takeoff Avionics Settings



Tune your NAV-1 radio, ADF, and COM to these settings before taking off from Kankakee.

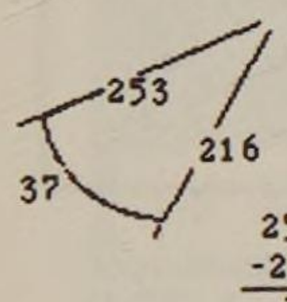
Look at the Chicago Area Chart in your *Flight Simulator* manual, or in Appendix C. Try to visualize the Peotone 253° radial extending from the VOR. If it's helpful, place a pencil or a ruler along the radial. Now look at runway 22 at Greater Kankakee. You'll fly from runway 22 to intercept the Peotone 253° radial.

Intercepting the 253° Radial

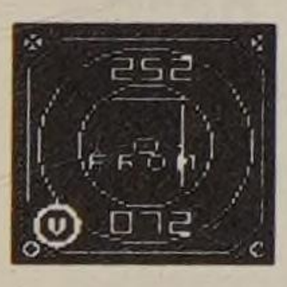
Take off from Greater Kankakee's runway 22 and immediately use this procedure to intercept the Peotone 253° radial.

Turn the airplane to parallel the desired course (253°).

Rotate the OBS to center the needle with a *FROM* indication since you'll be tracking from Peotone.



Calculate the difference between the desired radial and the radial that you're presently on (if you're currently flying on the 216° radial, you're 37° off the desired radial).



Reset the OBS to the desired course of 252° or 254° (or 253° on the Amiga or Atari ST versions of *Flight Simulator*).

Turn *toward* the needle, *past* the desired course by two times the number of degrees you're off course, but never more than 90°. Thus, if you're on the 216° radial, you're 37° off course and should turn right to 327° [253° + (2 * 37)]).

When the needle moves toward the center, turn to 253° and make any necessary corrections for wind, using the procedures discussed in Chapter 4.

By using this procedure, you'll intercept and follow the terminal route that will take you directly to the Dwight NDB. When Dwight NDB is within range, the needle on your ADF should point to Dwight NDB and be within a few degrees of *0*.

Automatic Direction Finder

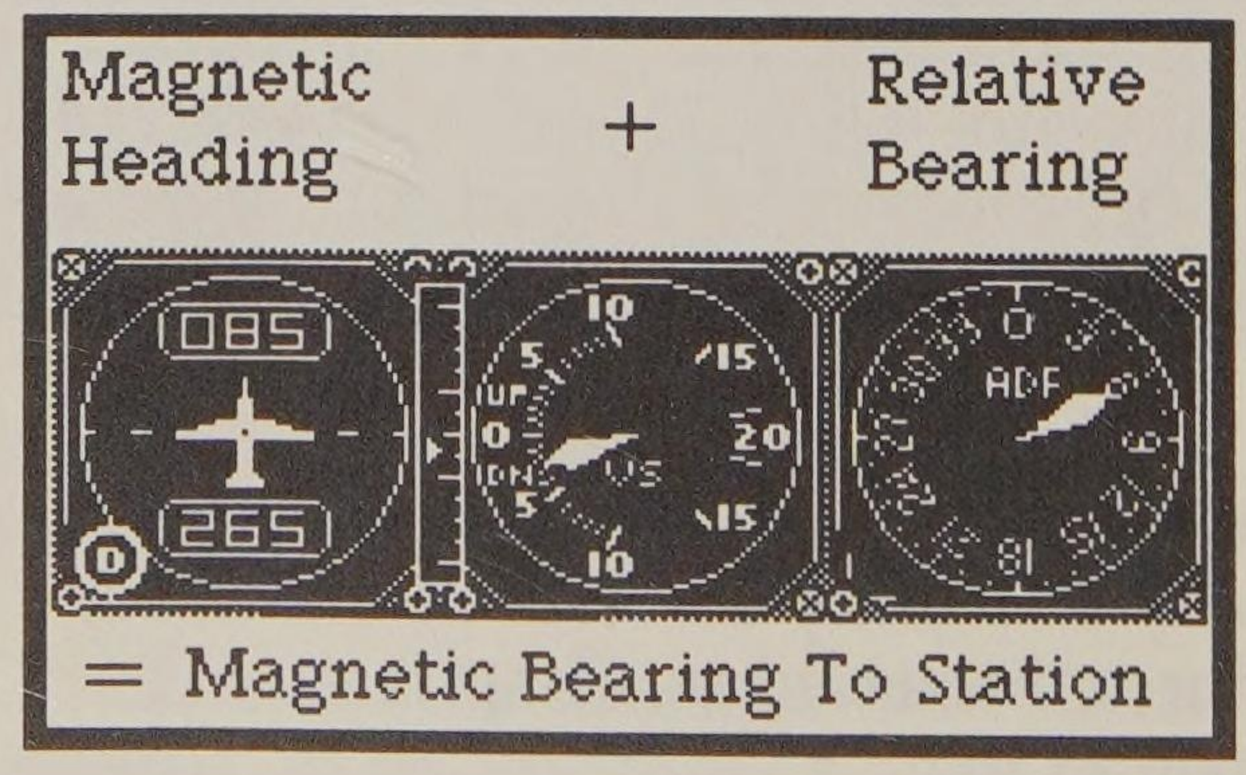
An automatic direction finder (ADF) is a relatively simple radio receiver that points directly *at* the transmitter to which it's tuned. In this respect it's far simpler than a VOR receiver. Many pilots, however, are confused by the use of an ADF.

The ADF display is a single needle on top of a compass rose. Unlike a VOR, ADF guidance is relative to the heading of the aircraft. The *0* on the compass rose represents the nose of the airplane, and the *18* represents the tail. If the needle points to the *6*, the NDB to which the ADF is tuned is 60° to the right of the airplane's nose. This 60° is referred to as the *relative bearing* of the NDB.

> On some versions of *Flight Simulator*, the ADF display uses a square box with marks at the four cardinal headings in lieu of a compass rose. On these displays, the relative bearing is displayed digitally at the top of the instrument.

The heading that will point the airplane right at the NDB is called the *magnetic bearing*. The magnetic bearing is found by adding the relative bearing to the airplane's current heading. For instance, if the airplane's current heading is 085° and the relative bearing is 60°, then the magnetic bearing is 145° (Figure 6-2).

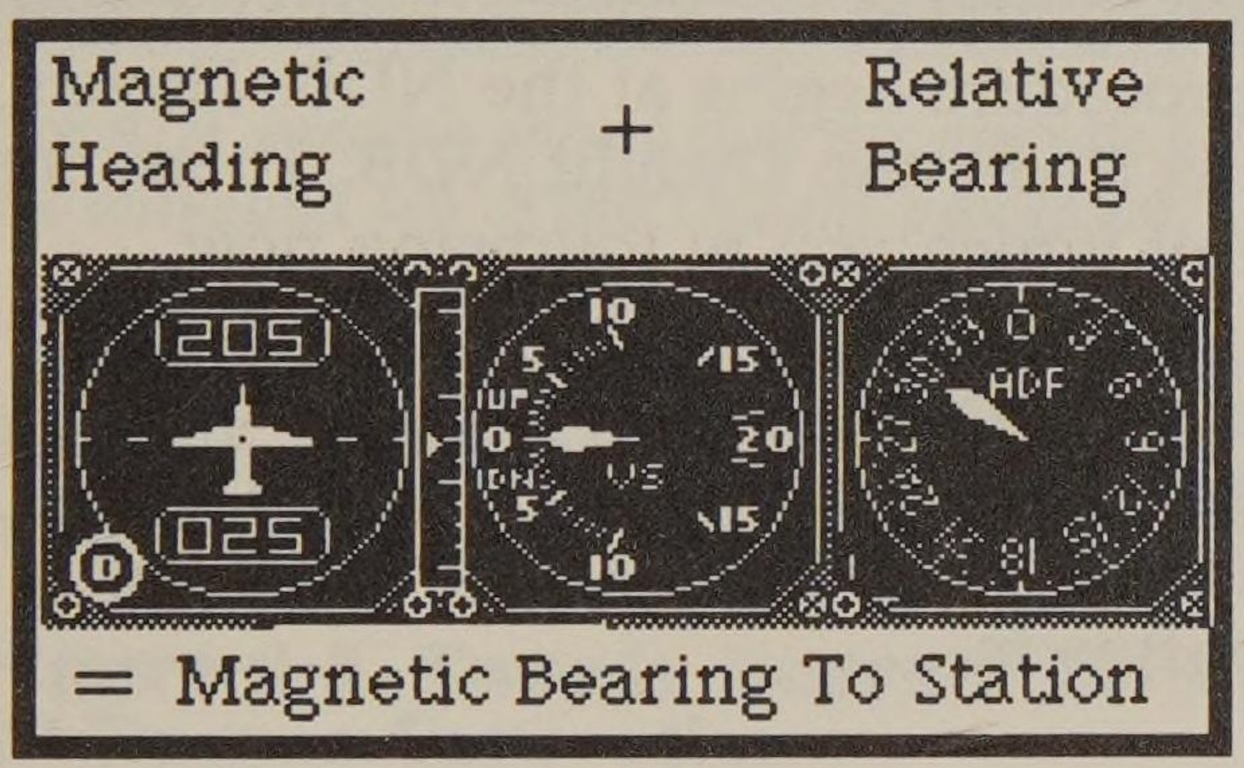
Figure 6-2. Magnetic Bearing of 145°



Add the airplane's current heading (85°) to the relative bearing shown on the ADF (60°) to find the magnetic bearing to the ADF station (145°).

If the sum of the magnetic heading and the relative bearing exceeds 360°, an additional step is needed to calculate the magnetic bearing. For example, assume the relative bearing is 300° and the magnetic heading is 205°. Since headings, bearings, and courses range from 0° to 360°, the magnetic bearing could not be 505°. Simply subtract 360° from the sum to find the magnetic bearing. In this example, the magnetic bearing is 505° − 360°, or 145° (Figure 6-3).

Figure 6-3. Magnetic Bearing of 145° Again



When the sum of the magnetic heading and the relative bearing is greater than 360°, you need to subtract that amount to arrive at the true magnetic bearing to the ADF station.

Don't be surprised that the result was the same in both examples. The airplane used in this example stayed in the same position when it turned from a heading of 85° to 205°. As the airplane turned, the ADF needle turned at the same rate. Since the airplane was in the same position both times, it only makes sense that the same heading now points the airplane toward the NDB.

Knowing what you now know, you could figure out how to use the ADF to track NDB bearings, with or without wind. To make it easier, though, the procedures for tracking NDB bearings are outlined below within the discussion of the NDB RWY 27 IAP to Dwight.

On to Dwight

Since the ADF needle always points *toward* the transmitter, you can recognize the moment you pass over the NDB when the needle moves from a relative bearing of 0° to a relative

bearing of 180° (or thereabouts). The speed at which the needle moves from nose to tail depends on how close you are to being right over the top of the transmitter. If you're exactly on course, the needle snaps around to the tail. More likely, you're slightly off course and the needle makes the change somewhat more leisurely. If you're significantly off course, the needle revolves slowly and may never move all the way to a relative bearing of 180°.

The NDB RWY 27 IAP is not significantly different from the VOR IAP you made at Greater Kankakee. Again, the IAP is of the terminal type since the NDB is located on the airport and the missed approach procedure begins at the NDB. There's only one initial approach fix (IAF), the Dwight NDB. There are three terminal routes, one of which you're following now.

Again, the procedure turn must be made within ten nautical miles of the NDB. The minima section reveals that the minimum descent altitude (MDA) does not differ if you circle to land on another runway, nor does it depend on which approach category your aircraft is in.

Procedure at Dwight

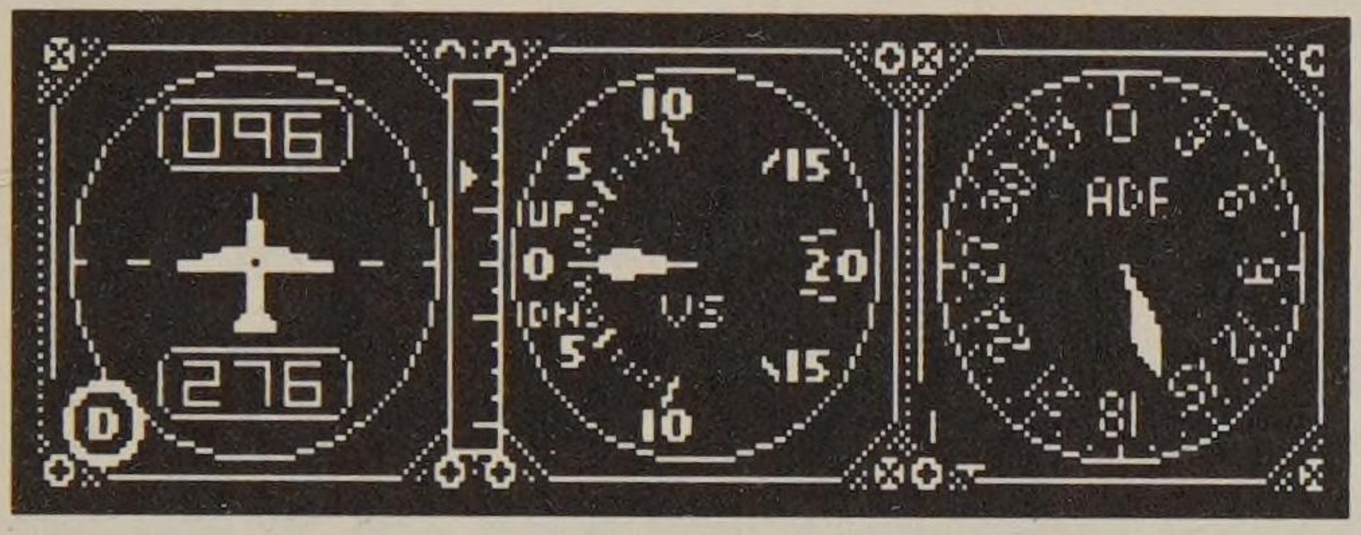
Since 2300 feet is the initial approach altitude (as you can see from the underlined *2300* in the the profile view), you're already at the appropriate altitude. When the ADF needle swings toward the tail, you've passed over the NDB. Turn left to 096°, the outbound heading shown in the planview. As you make the turn to 096°, the ADF needle will move toward the nose. Once again you'll pass over the NDB, this time heading away from it, or outbound.

It's necessary to calculate your distance from the NDB to make sure you remain within ten nautical miles. The only way to do this is to time your outbound leg. You should leave yourself at least three miles for the procedure turn, so start the outbound portion of the procedure turn no more than seven miles from the NDB. If your groundspeed is 120 knots, your airplane travels two miles per minute, and you should begin the procedure turn within 3½ minutes of crossing the NDB the second time.

After you've passed the NDB, you may need to make a course correction. If the relative bearing is not 180°, turn *toward* the needle twice the number of degrees that the relative

bearing varies from 180°. Figure 6-4 shows the airplane 20° off course (a 160° relative bearing on the outbound heading).

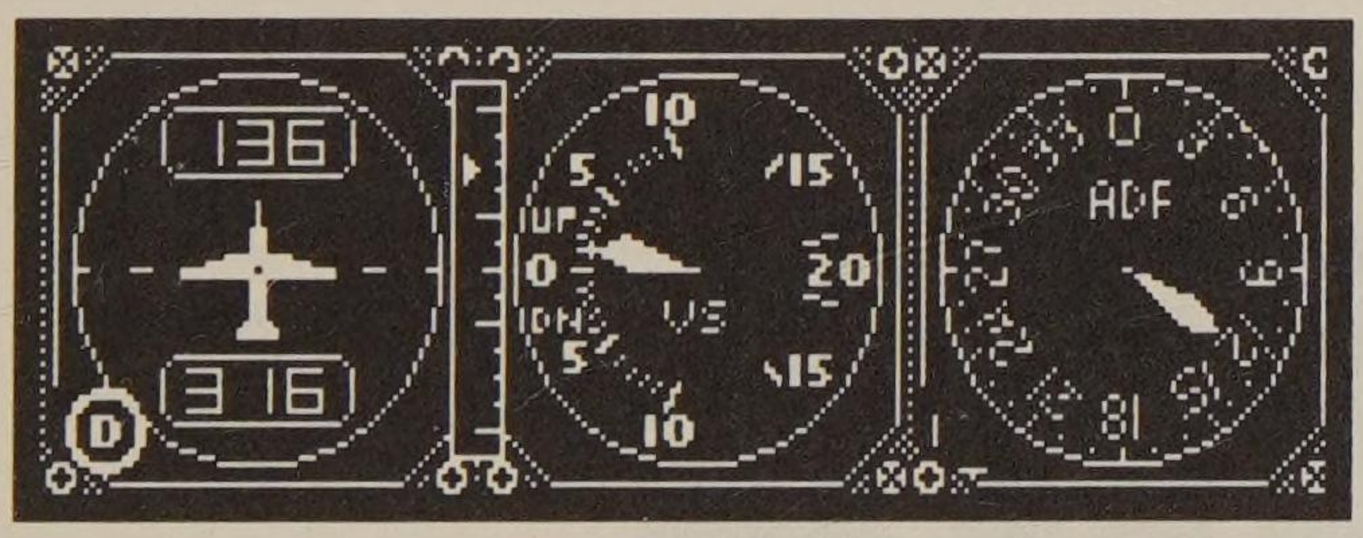
Figure 6-4. Twenty Degrees Off Course



The ADF reading shows that the aircraft is 20° off course while on the outbound leg of the Dwight procedure.

The airplane should be turned 40° to the right (toward the ADF needle) to a heading of 136°. When the airplane is heading 136°, the relative bearing will be 120° (Figure 6-5).

Figure 6-5. Twenty Degrees Off Course with a 40-Degree Correction



When you correct your course by 40°, the relative bearing seems to show that you're even more off course than before. Don't worry—you're not.

Keep the airplane on the 136° heading until the relative bearing is 140° (that's the amount of the course correction away from the tail [180 − 40]). At that point, the airplane is back on the outbound course, *but not on the outbound heading.* (The relative bearing of 140° plus the magnetic heading of 136° equals the inbound course of 276°.)

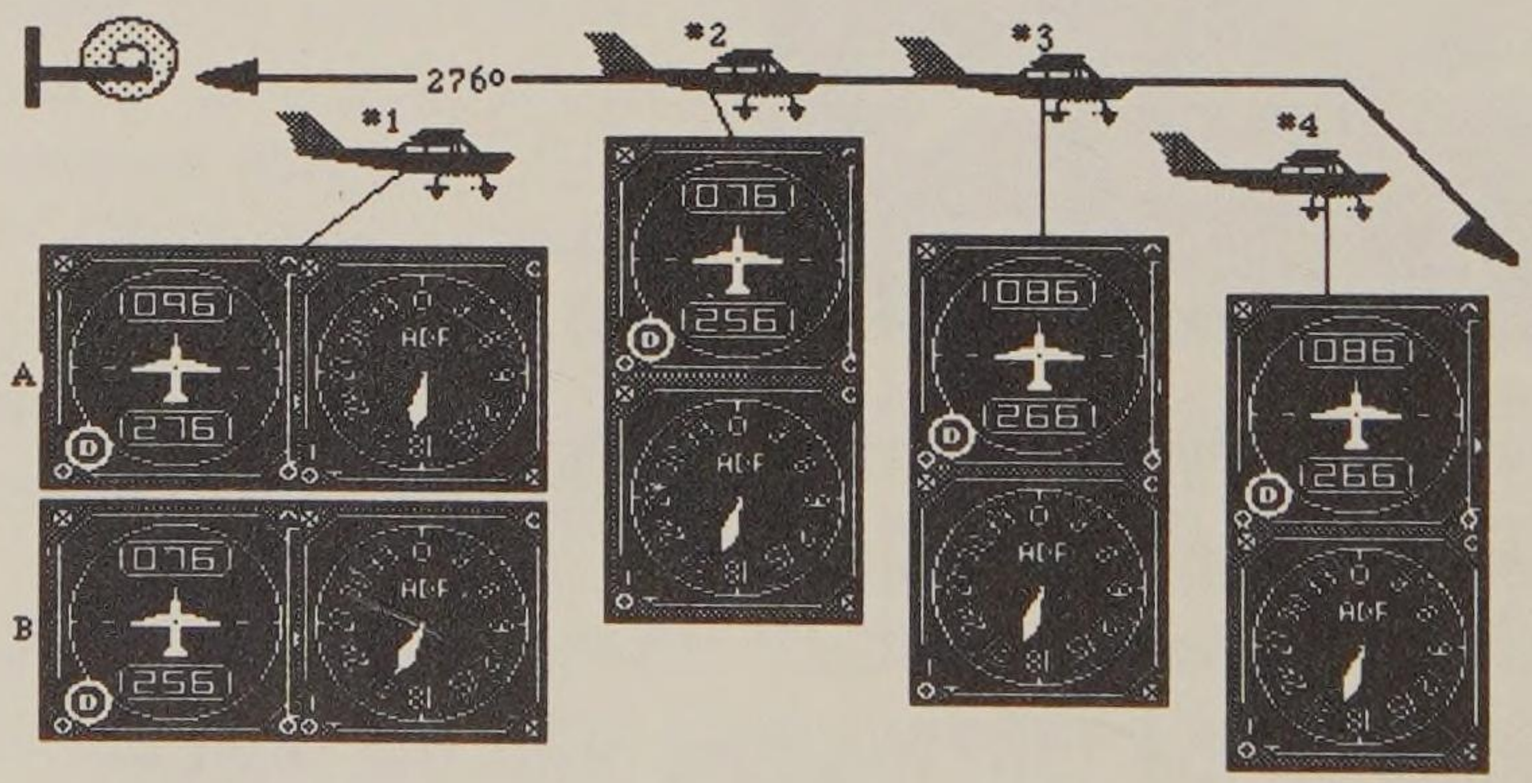
Assuming there's no wind, once you're back on the outbound course, you'll want to return to the outbound heading of 96°.

Wind

Once you've established the airplane on the outbound course, course corrections will be necessary if the wind isn't calm. Use this procedure to track the NDB bearing:

- If the needle moves 5° or more from the nose or tail (Figure 6-6, #1A), depending on whether you're inbound or outbound, turn the airplane 20° *toward* the needle (Figure 6-6, #1B).
- Fly the new heading until the needle is 20° away from the nose or tail, as appropriate. You're back on course (Figure 6-6, #2).
- Establish a wind correction angle by turning 10° toward your original heading (Figure 6-6, #3). The needle will now point 10° from the nose *opposite the direction* of your wind correction angle if you're inbound to the NDB, or 10° from the tail in the *same direction* as your wind correction angle if you're outbound from the NDB.
- If the needle drifts closer to the nose or further away from the tail, the wind correction angle is insufficient. If this happens, repeat the first three steps above, except use a 15° wind correction angle instead of 10° (Figure 6-6, #4).

Figure 6-6. Wind Correction



Follow this procedure to make course corrections while tracking the NDB bearing.

If you're traveling over the ground at 120 knots or less, you should begin the procedure turn 3½ minutes after passing over the NDB the second time. Once you've completed the procedure turn and have established yourself on the inbound course, you'll need to descend from 2300 feet to 1380 feet, and then from 1380 feet to 632 feet, the airport elevation. At a

descent rate of 500 feet per minute, you'll need almost 3½ minutes of flying time if you're traveling at 120 knots.

Procedure Turn

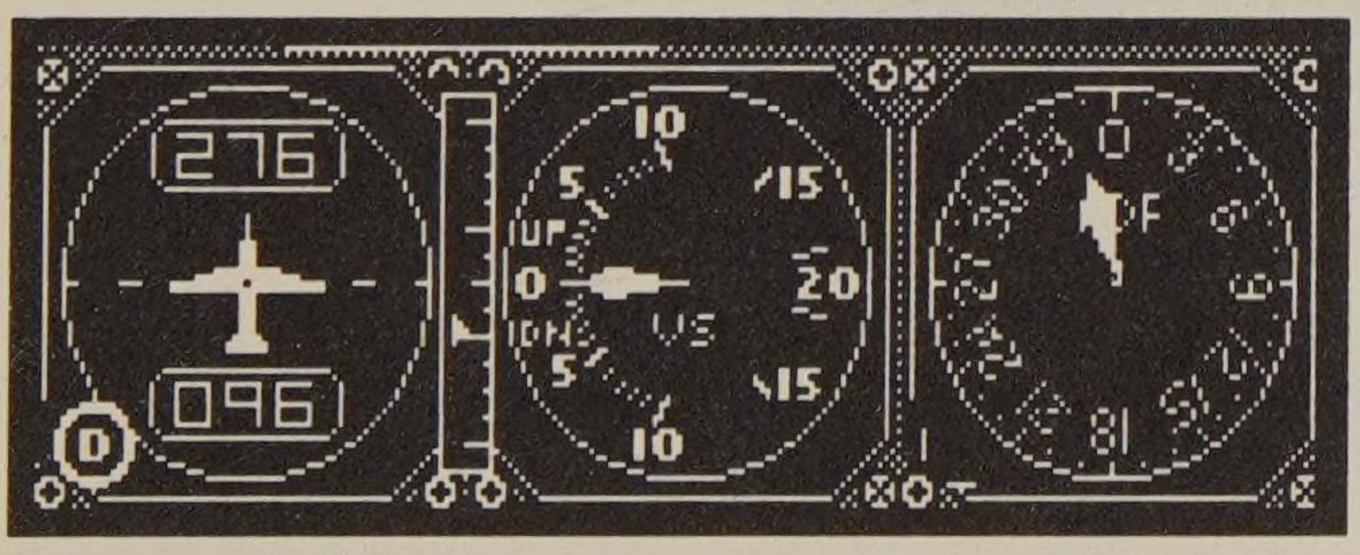
Make the procedure turn by turning right to a heading of 141° for one minute, followed by a left turn to a heading of 321° until you're established on the inbound course. The procedure turn is at a 45° angle to the inbound course, so when the ADF needle is 45° to the left of the nose (a relative bearing of 315°), the airplane is on the inbound course and must be turned to the inbound heading.

Once you're on the inbound course, you may begin your descent to the minimum descent altitude (MDA), which for this IAP is 1380 feet. When you reach that altitude, level off the airplane and maintain 1380 feet until you have the runway in sight and are in a position from which a normal landing can be made (in which case you may descend below the MDA and land), or until you pass the Dwight NDB (in which case you must follow the missed approach procedure instructions printed in the profile).

Tracking Inbound

The same procedures used for tracking outbound are used for tracking inbound. Figure 6-7 shows an airplane on the inbound heading. Its ADF needle has drifted 10° to the left of the nose, meaning that the airplane is 10° right of course.

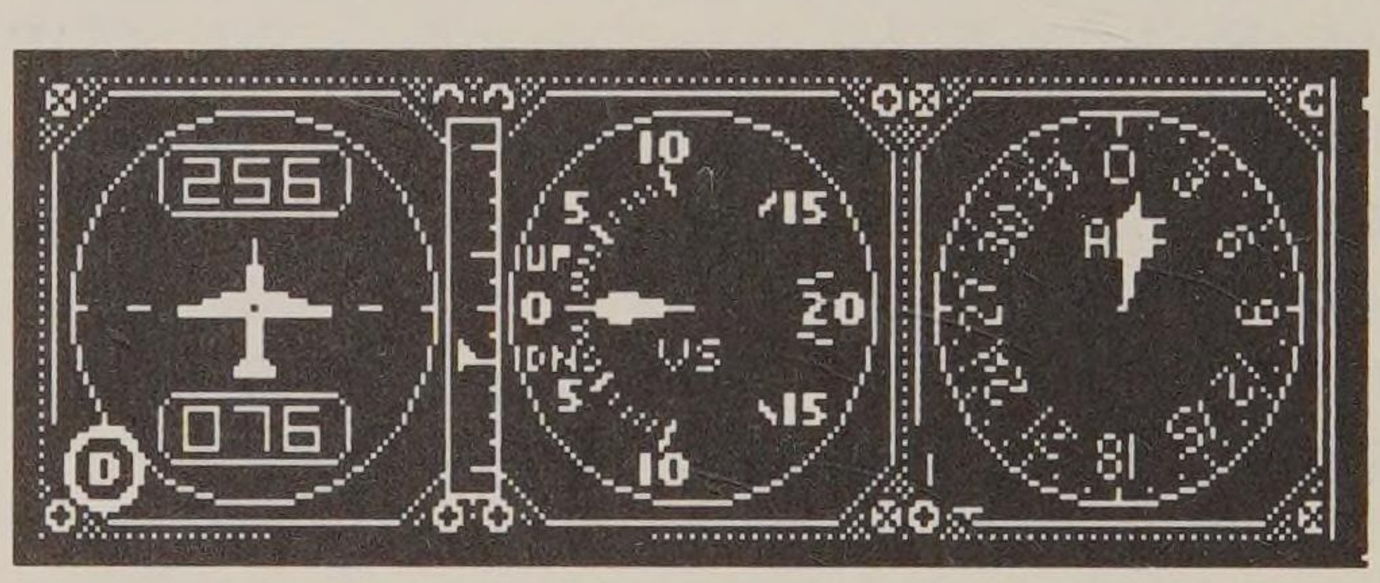
Figure 6-7. Ten Degrees Right of Course



This airplane is off course while inbound. The heading is correct, but the ADF shows that the aircraft is 10° right of the correct course.

Using the NDB tracking procedures, turn the airplane 20° to the left (toward the needle). As the airplane turns, the ADF needles also turns 20°, though in the opposite direction (Figure 6-8).

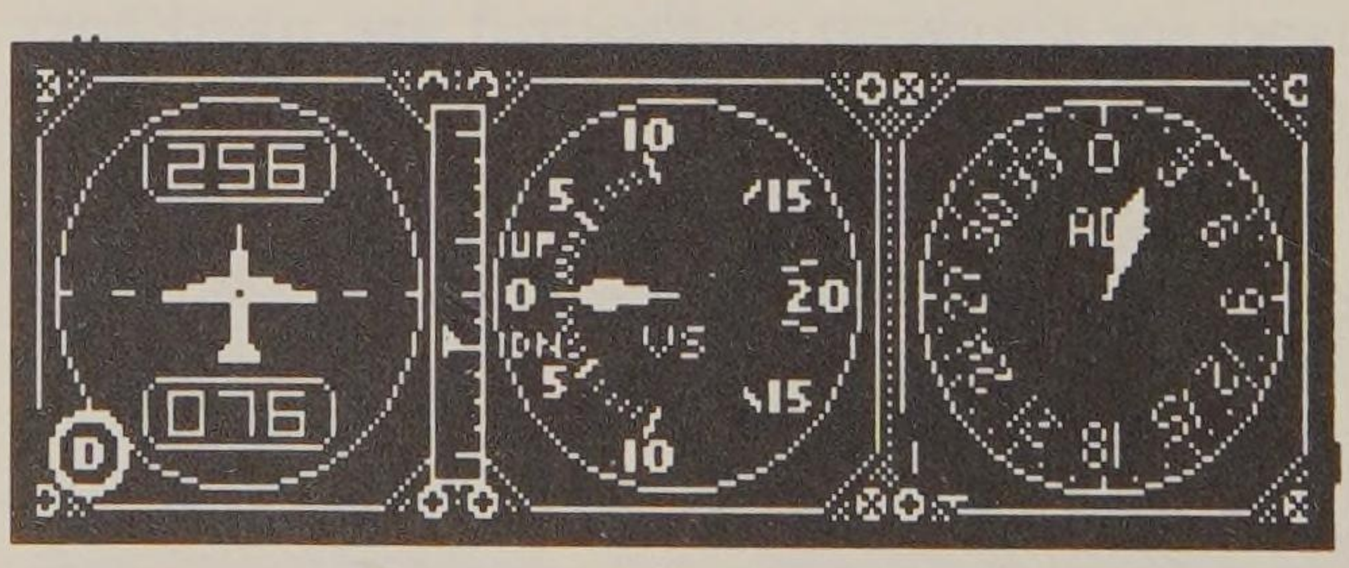
Figure 6-8. Ten Degrees Right of Course with a 20-Degree-Left Correction



Correcting the course by changing the heading 20° also changes the ADF needle's position. Note, however, that the ADF needle turns 20° in the opposite direction of the course correction.

When the needle is 20° to the right of the nose, the airplane is back on course (Figure 6-9).

Figure 6-9. Back On Course



The airplane is back on course when the ADF needle reads 20° right of the nose.

Now, turn the airplane 10° to the right. The airplane will remain on course if 10° is the appropriate wind-correction angle.

Missing Dwight

If you followed all the instructions, you should now be executing the missed approach procedure. That's because the cloud base was set to 1192 feet—as you flew at 1380 feet, you never saw the runway.

Return to 2300 feet and head back to the Dwight NDB. Since the cloud ceiling is too low to let you land at Dwight, continue on to your final destination—Champaign, Illinois.

If you descended below the MDA *before* you had the runway in sight, remember one thing—there are **old** pilots, and there are **bold** pilots, but there are no **old bold** pilots.

Chapter 7

ILS Approaches

Chapter 7

ILS Approaches

Learn how to use the ILS (Instrument Landing System) to execute precision instrument approaches—and land in the nastiest of weather conditions.

Begin this chapter with the following settings to *Flight Simulator*:

Cloud base	**1192**
North position	**16874**
East position	**16404**
Altitude	**630**
Season	**Winter**

Up to now, you've practiced nonprecision instrument approach procedures using VORs and NDBs. The ILS (Instrument Landing System) approach procedure adds a new dimension to instrument flying.

ILS approaches are precision approaches in that they provide electronic glidepath information. In addition to a course guidance system which uses the NAV-1 radio in a similar way to that used by a VOR approach, the ILS provides glidepath guidance (more on that term later). Because of their precision, most ILS IAPs allow a pilot to descend to a mere 200 feet above the touchdown zone elevation before committing to the landing.

The Instrument Landing System

The ILS is made up of a localizer, glideslope, marker beacons (outer, middle, and inner), and DME.

Localizer. The *localizer* is a ground-based transmitter which provides course guidance for the pilot. Unlike a VOR, the localizer has only one fixed course, and it will not vary if you turn the OBS. The width of the localizer is one-fourth the width of a VOR radial. That means the needle on the indicator is much more precise in its reading. When you're tracking a VOR radial, for instance, and the needle on the indicator is

fully to one side, it means you're 10° off course. Using the ILS and seeing the same reading, however, means that you're only 2½° off course.

When you're tracking inbound on an ILS IAP, you make course corrections in the direction of the needle. If the needle appears to the right of center, you turn the airplane in that direction. When you're tracking outbound, however, course corrections are made *away* from the needle, just as you would with a VOR if you were tracking inbound with a *FROM* indication.

Although the OBS has no effect on the ILS, I recommend you set the OBS to the inbound course as a reminder of the inbound heading. Additionally, if you ever use your NAV-2 radio for localizer tracking, a quirk in the programming, at least on some versions of *Flight Simulator,* requires that you select the inbound course on the OBS.

Unlike flying over a VOR, when you fly over the localizer transmitter, there will be no indication that you've passed it other than the fact that when you're very close to the transmitter it's very sensitive.

Glideslope. The *glideslope* is easy to understand if you imagine a localizer transmitter turned on its side and transmitting a single course upward at a 3° angle. The glideslope is shown in the cockpit by a horizontal needle on the NAV-1 display (Figure 7-1).

Figure 7-1. Horizontal Needle Shows on Glideslope Indication

Glideslope indication appears on the NAV-1 display.

If the glideslope needle moves above center, you're too low. If the glideslope needle moves below center, you're too high.

Appendix B includes a Rate of Descent Table, which shows the rate of descent you must maintain for a given speed and glideslope angle to keep within the glideslope. The glideslope angle is listed in the profile section of an ILS IAP chart next to the letters *GS*.

DME and Marker Beacons. Distance information is provided by DME and *marker beacons*. Marker beacons are ground-based radio transmitters which transmit an elliptical pattern that's displayed in the cockpit as the airplane passes over the antenna. Most ILS IAPs employ an outer marker and a middle marker. The outer marker marks the approximate position where an aircraft at the initial approach altitude will intercept the glideslope.

An ILS IAP

Take a look at the profile of the ILS RWY 32 IAP to Champaign-Urbana Airport. It's on page 131 in Appendix B. The initial approach altitude is 2600 feet, indicated by the underlined *2600*. The glideslope intercept point is marked by *2573*, which is the exact altitude of the glideslope over the outer marker. The middle marker (MM on the profile) indicates the position at which an aircraft on glideslope is required to continue descent for landing or execute the missed approach procedure.

Inner markers are associated with a special type of ILS IAP that's not found on *Flight Simulator*. On some ILS IAPs, there's no outer marker (ILS RWY 24 IAP to Martha's Vineyard, Massachusetts, for instance). If that's the case, DME may be substituted for the outer marker if it's shown on the IAP chart (on the Martha's Vineyard ILS RWY 24 IAP chart profile and planview, *I-MVY 5 DME* is printed at the glideslope intercept point, BORST intersection).

No Minimum Descent Altitude

A significant difference between precision and nonprecision IAPs is that precision approaches do not have minimum descent altitudes (MDAs). Instead, precision approaches are made along the glideslope to a decision height (DH). When the airplane reaches the decision height, the pilot must immediately decide whether the requirements to continue the

approach have been met or whether the missed approach procedure must be executed.

The requirements for continuing the approach below the decision height are the same as for descending below an MDA on a nonprecision approach—the pilot must have the runway or certain elements of the runway environment (such as its lights) in sight and be in a position from which a normal landing can be made.

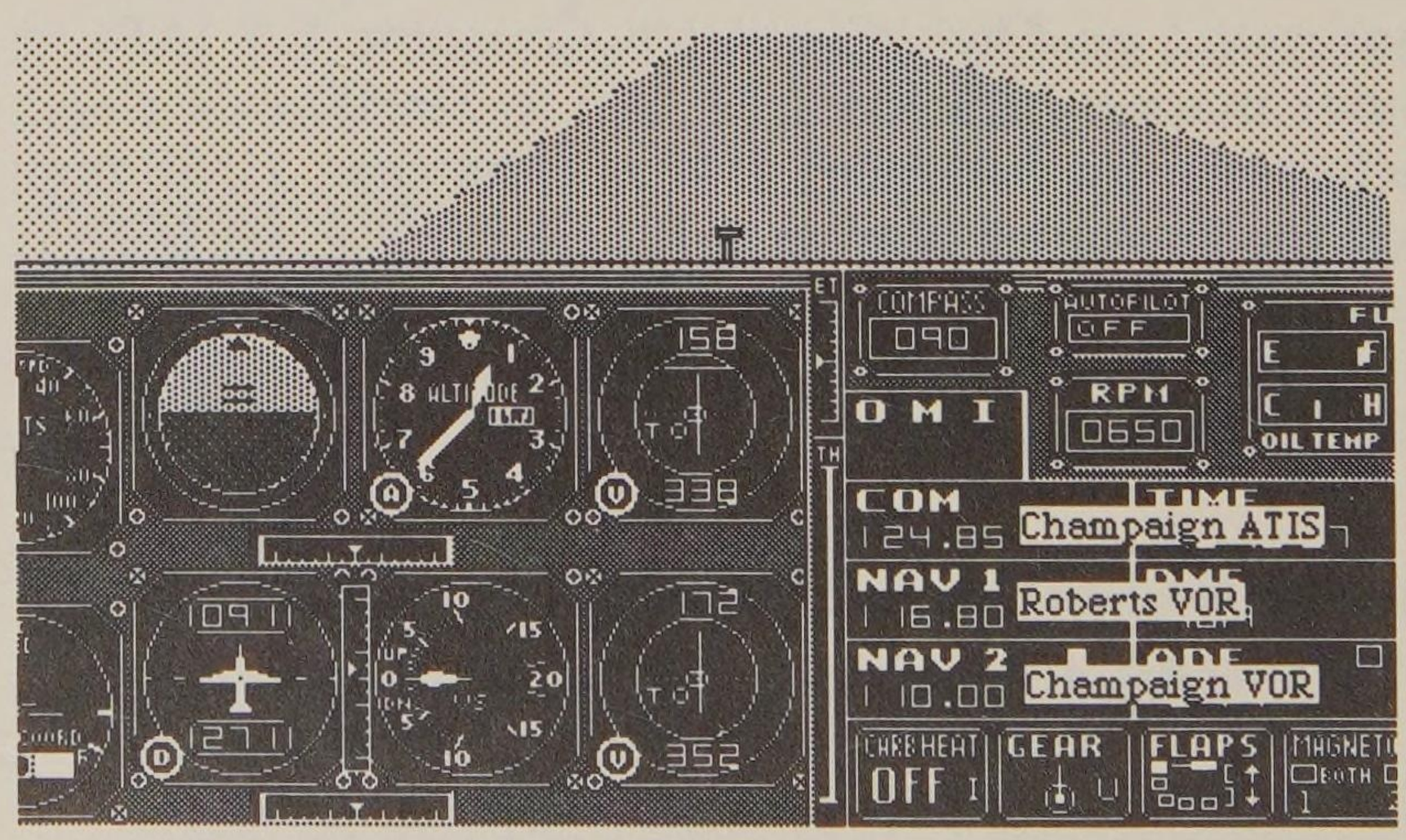
Give ILS a Try

You should either be on the ground at Dwight Airport or flying nearby at 2300 feet. Your clearance for the last leg of today's flight is:

Cleared to the Champaign-Urbana Airport via direct Roberts direct, climb and maintain 2,600.

You should set up your radios just as you have for the previous two legs of today's flight. Set the NAV-1 radio to the Roberts VOR frequency, 116.8. Set the NAV-2 radio to the Champaign VOR frequency, 110.0. Turn the OBS on both to center the needles with a *TO* indication. Since Dwight Airport doesn't have a control tower, you can go ahead and set the Champaign ATIS frequency, 124.85, in the COM radio (Figure 7-2).

Figure 7-2. Pre-Takeoff Avionics Settings



This is what your NAV-1, NAV-2, and COM radios should show before you begin the last leg of your trip.

If you're on the ground at Dwight, take off and proceed direct to Roberts while climbing to 2600 feet. Since the Dwight NDB RWY 27 IAP chart doesn't contain a *T* in an upside-down triangle, you know there's no published departure procedure for Dwight Airport.

If you're already airborne, climb to 2600 and proceed as cleared.

While en route to Champaign-Urbana, locate the ILS RWY 32 IAP chart in Appendix B and study it. You'll notice that there's only one initial approach fix (IAF)—the VEALS LOM, near the center of the planview. LOM, or Locater Outer Marker, is the name given to an NDB that's co-located with an outer marker. If your airplane is equipped with a functioning ADF, use VEALS as the IAF.

> Note: On some versions of *Flight Simulator,* VEALS was incorrectly co-located with the middle marker. You can still use it as the IAF, but you should ignore your ADF after getting established on the outbound course.

If your ADF isn't functioning, you'll have to improvise a little. Use the Champaign VOR as an IAF.

Flying In

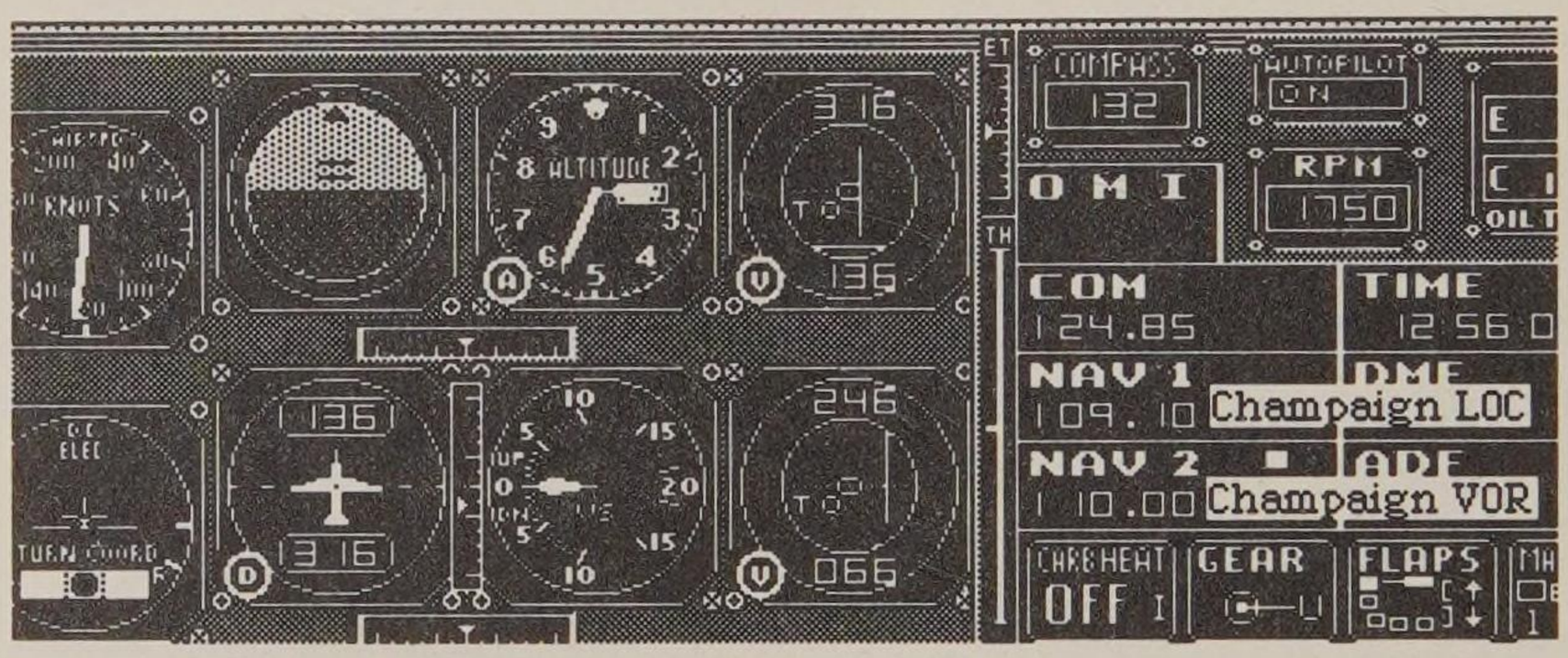
Whatever you're using as an IAF, track from Roberts VOR to Champaign VOR. If you're using VEALS as the IAF, proceed directly to VEALS once you've received it.

After passing Roberts VOR, set your NAV-1 radio to 109.1, the Champaign localizer frequency. Remember to set the OBS to the inbound course of 316°. You're still reading the needle of the NAV-2 radio to track to the Champaign VOR, however.

When the localizer needle begins to center, turn left to track the localizer outbound on a 136° heading. Remember that the localizer needle now has reverse sensing—that is, make course corrections *away* from the needle rather than toward it (Figure 7-3).

Again, the IAP instructs you to remain within ten nautical miles, though this time it means within ten nautical miles of the outer marker. Since your DME is measured from the runway, you can add the distance from the runway to the outer marker (six miles) and allow yourself to go no further than 16 DME from the runway.

Figure 7-3. Tracking the Localizer



As you fly outbound on the localizer, your airplane has drifted slightly to the right of the proper course, as shown by the needle. To correct course, you need to turn slightly to the left.

Try starting the procedure turn at approximately 10 DME. Fly a 091° heading for one minute. After one minute, turn right to 271° and hold that heading until the needle begins to center.

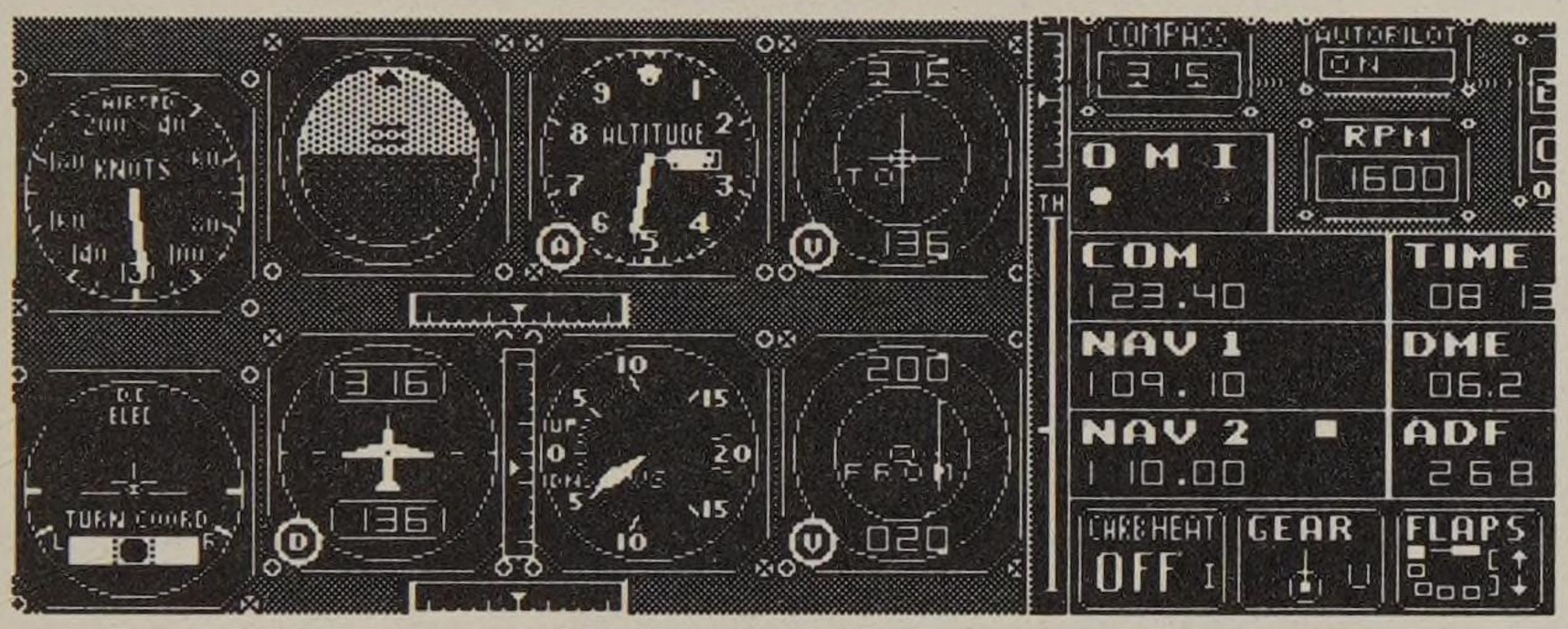
As the needle centers, turn right to the inbound course of 316°. Because the localizer is more sensitive than a VOR, use small corrections—no more than 2 or 3 degrees at a time.

As you approach 6 DME, the glideslope needle (the horizontal needle) begins to move downward from the top of the NAV-1 display. As the glideslope needle approaches the center, reduce the throttle setting so that you maintain both your desired approach speed and the rate of descent necessary to stay on the glideslope at that approach speed. You can find the correct rate of descent from the Rate of Descent Table in Appendix B. Turn to it now.

The angle of descent for this IAP is 3.0°—shown by the *3.00°* beside the *GS* in the profile. Assuming 90 knots groundspeed, and using the *3.0* row on the Table, you can see that the necessary rate of descent is 480 feet per minute.

At 6.0 DME, you should pass over the outer marker. The IAP (in the profile) shows that you should be at 2573 feet when you fly over the marker. As you continue the approach, try to keep both the localizer and the glideslope needle centered. Make whatever small corrections toward the needles are necessary.

Figure 7-4. Intercepting the Glideslope



The instruments show that this aircraft is right on the glideslope as it passes over the outer marker.

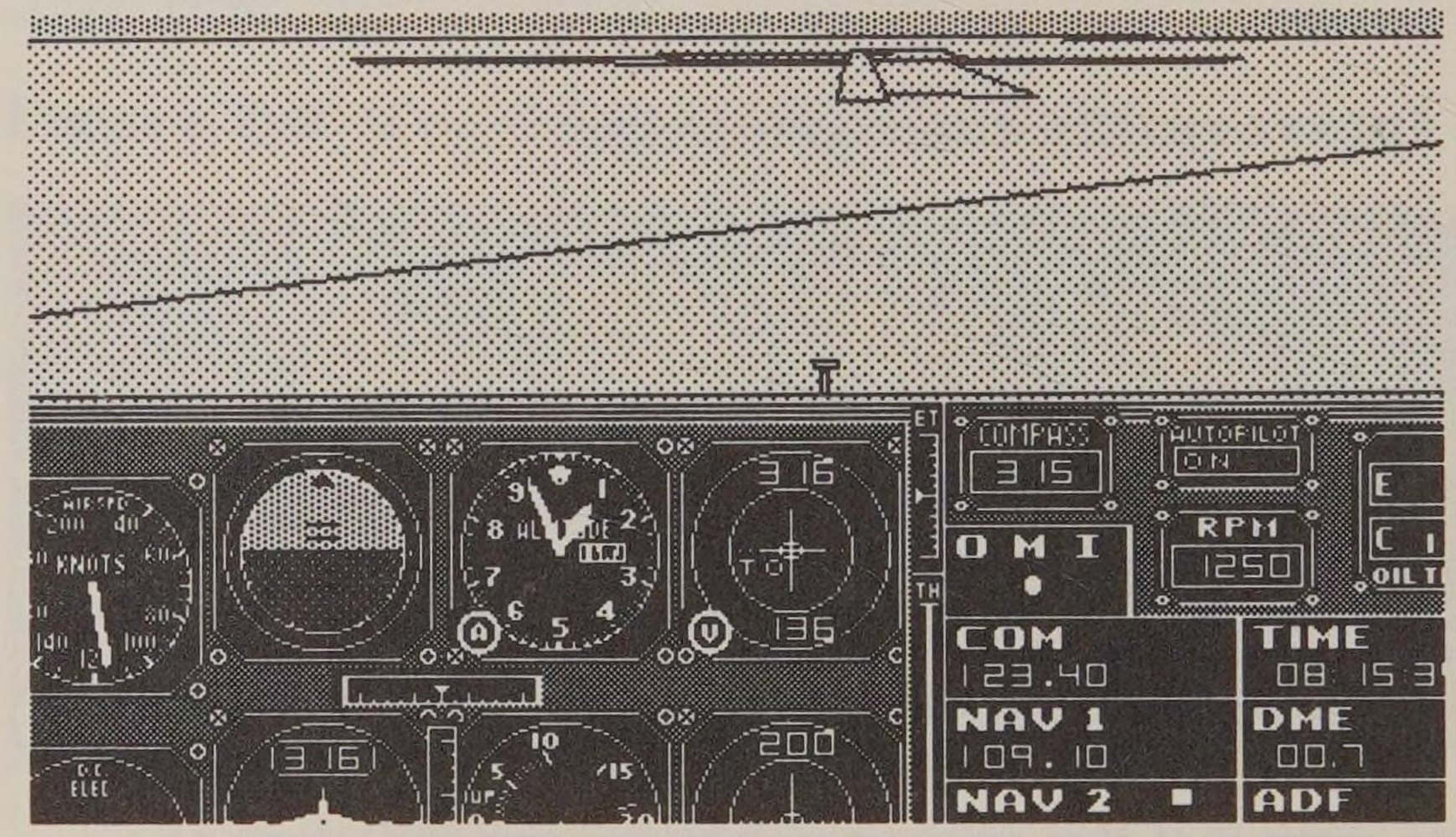
If you look at the minima section of the IAP chart, you'll see that the decision height (DH) for this approach is 949 feet (as indicated by *949/24*), exactly 200 feet above the touchdown zone elevation of runway 32. As the airplane descends below 1192 feet, you should break out of the clouds and see the runway. When the airplane reaches 949 feet, you must immediately decide whether to continue the approach below the DH or execute the missed approach procedure. The middle marker should be a second reminder of when you must make that decision.

Make sure you're familiar with the method your version of *Flight Simulator* uses to tell you that you've passed an outer, middle, or inner marker.

On the Macintosh, for instance, a light appears beneath the *O, M,* or *I* located immediately above the COM radio frequency. (Contrary to the documentation, there is no audio signal.)

If the runway is in sight and you're in a position from which a normal landing can be made, land at Champaign-Urbana Airport and complete the day's flight.

Figure 7-5. Descending Below the Decision Height



You're below the decision height and ready to make a normal landing.

You may be wondering why you executed the ILS RWY 32 IAP and then landed on runway 31. Did you land on the wrong runway? At the wrong airport?

No. Runways are numbered by their magnetic headings. The relationship between true north and magnetic north varies in different parts of the country. This variation changes over time. When the database for *Flight Simulator* was being designed, what is now runway 32 at Champaign-Urbana Airport *was* runway 31. When the magnetic heading of the runway became 315°, the runway number was changed to 32.

You may find other IAPs where there's a discrepancy between the chart and the database in *Flight Simulator*. In most cases a little improvisation will easily correct the situation.

Chapter 8

Variations

Chapter 8

Variations

This last chapter offers variations on the approaches you've already learned and practiced. After you've mastered these approaches, you'll be well prepared to delve into the many instrument approach procedures which await you in Appendix B.

Night ILS Approach

Begin this section with the following settings to *Flight Simulator*:

Cloud base	**275**
North position	**17490**
East position	**22043**
Altitude	**68**
Time	**23:45**

You're on the ground at Martha's Vineyard Airport in Massachusetts. It's almost midnight, and the clouds are just 207 feet above the ground. You're about to take off, fly the ILS RWY 24 IAP, and land. Turn to page 173, Appendix B, and study the IAP chart.

Taxi your airplane out to the end of runway 6 and set up your avionics for the flight. Tune your NAV-1 radio to the localizer frequency (108.7), your NAV-2 radio to the Martha's Vineyard VOR (108.2), and your COM radio to the control tower (121.4). Set your NAV-1 OBS to the inbound course of 236°. After you've looked carefully at the IAP chart, start your takeoff roll.

As you lift off from runway 6, track outbound along the localizer while climbing to 1500 feet. You should be flying at a heading of 56°. When you enter the clouds, the windshield turns pitch-black. It's just you and the instruments this time.

Remember that the localizer needle has *reverse* sensing while you're outbound.

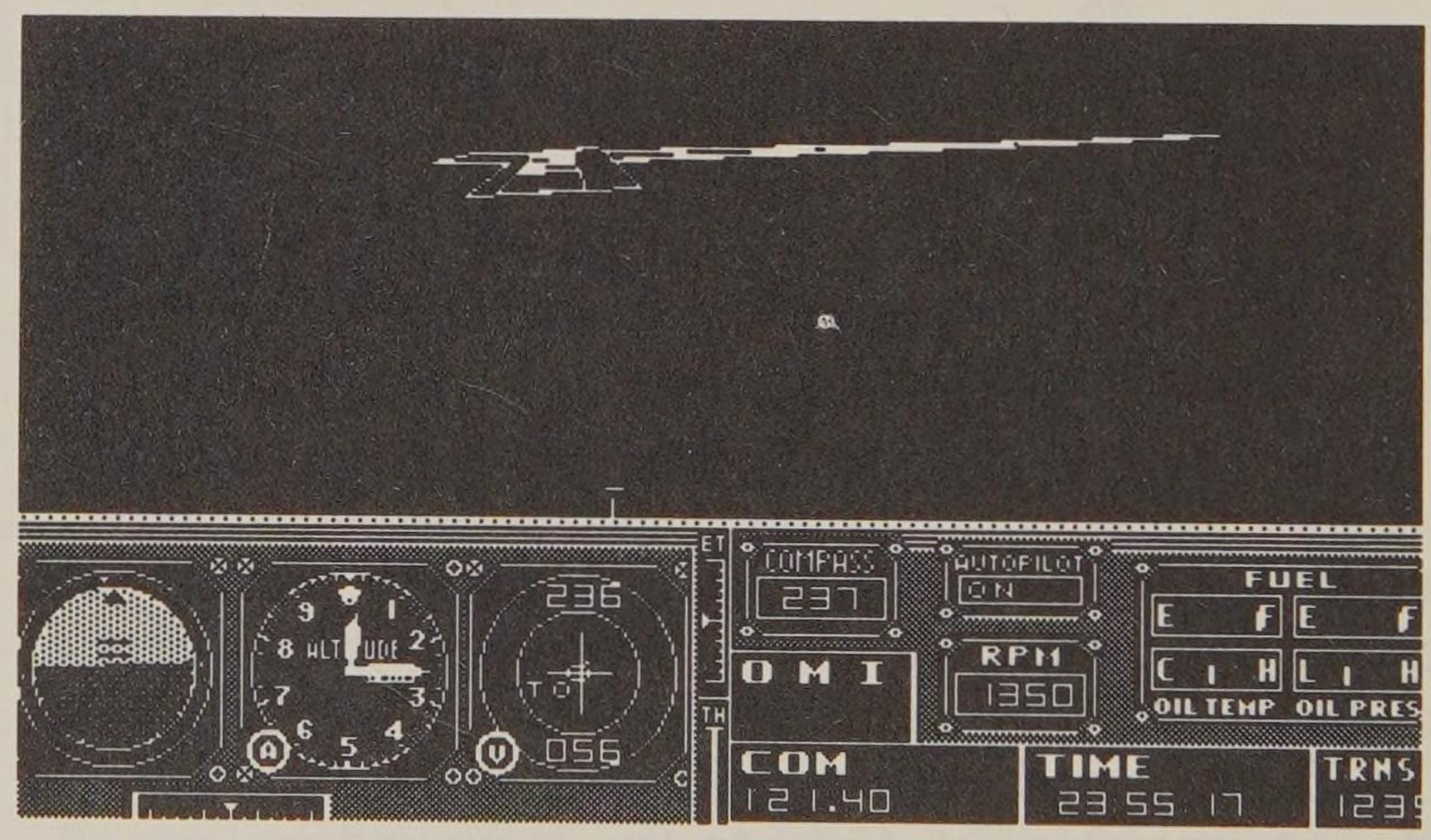
There's no procedure turn on this IAP. When you see a boldface racetrack-like pattern on the planview—as you do

here—it means that you use the holding pattern for your course reversal instead of a procedure turn.

It's really quite easy. When the DME reads 5.0, turn right 30° to an 86° heading, and fly that heading for one minute. Then turn left at standard rate to the inbound course heading of 236° and re-intercept the localizer course inbound.

As you approach the 5.0 DME mark, the glideslope needle will begin to descend from the top of the localizer display. As the glideslope needle approaches center, reduce the throttle and begin your descent along the glideslope. Just before you get to the decision height (DH), which is 263 feet, you should break out of the clouds and see the runway lights. If you land safely, you've just completed your first overwater instrument approach at night with the weather near minimums. Congratulations!

Figure 8-1. At Decision Height at Night



Just before you reach the decision height of 263 feet, you should break out of the clouds and see the runway lights in front of you.

VOR/DME Approaches

Begin this section with the following settings to *Flight Simulator*:

Cloud base	**800**
North position	**17733**
East position	**21543**
Altitude	**697**

You're on the ground at Southbridge Municipal Airport, which is between Hartford, Connecticut and Boston, Massachusetts.

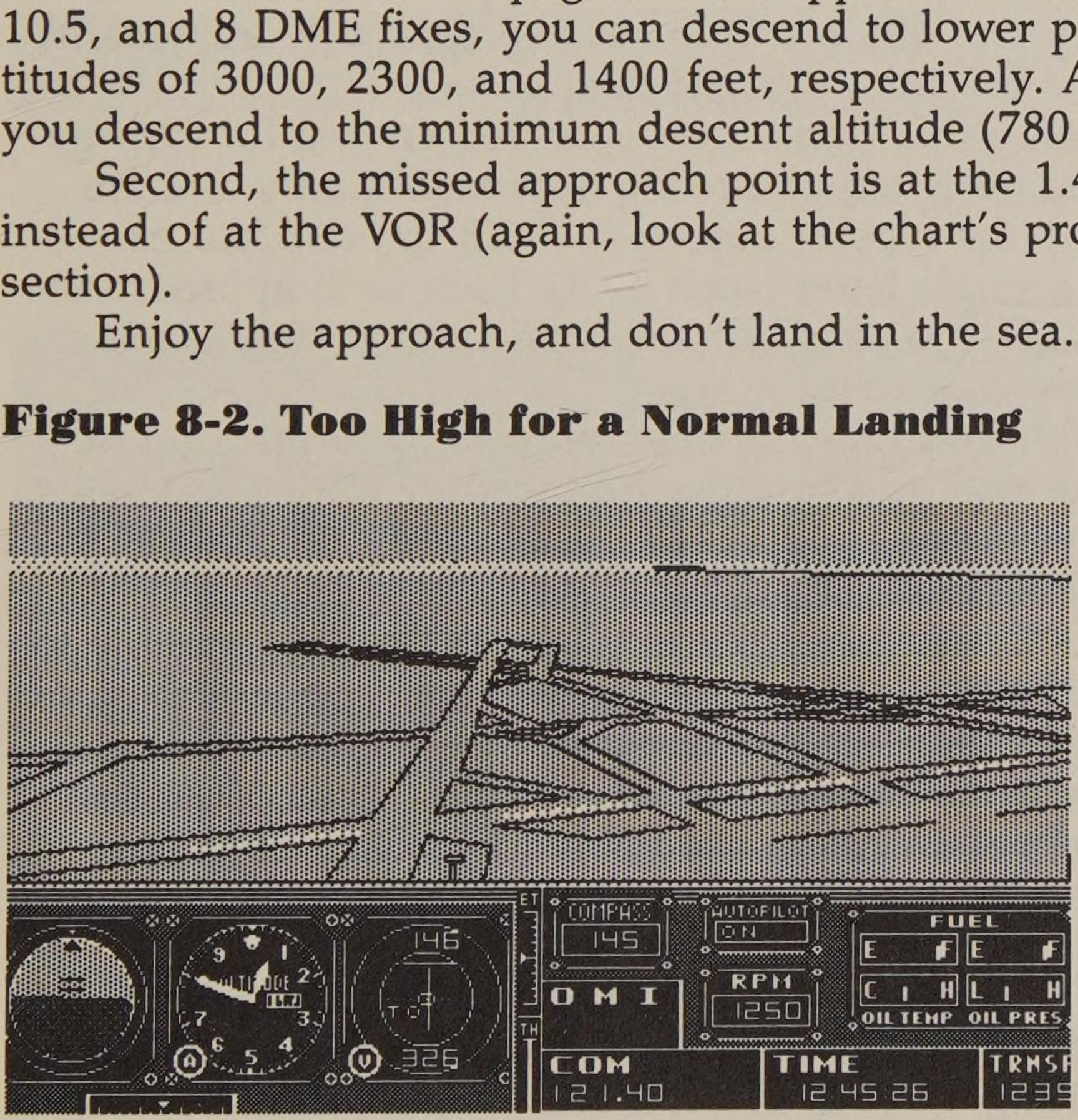
Take off to the north and track direct to Gardner VOR (110.6) at 4000 feet. When you arrive at Gardner, you're cleared for the VOR/DME RWY 15R IAP to Boston/General Edward Lawrence Logan International.

There are only two significant differences between this approach and others that you've already flown. First, there are three stepdown fixes along the approach in addition to the final approach fix. Look at the profile view of the VOR/DME RWY 15R IAP chart on page 122 of Appendix B. At the 15, 10.5, and 8 DME fixes, you can descend to lower published altitudes of 3000, 2300, and 1400 feet, respectively. At 5 DME, you descend to the minimum descent altitude (780 feet).

Second, the missed approach point is at the 1.4 DME fix instead of at the VOR (again, look at the chart's profile section).

Enjoy the approach, and don't land in the sea.

Figure 8-2. Too High for a Normal Landing



This airplane is obviously too high for a normal landing. Its pilot should execute the missed approach procedure and then try again.

Circling Approaches

Begin this section with the following settings to *Flight Simulator*:

Cloud base	**900**
North position	**14974**
East position	**6095**
Altitude	**28**

Circling approaches were discussed briefly in Chapter 5. A circling approach is made when the executed IAP serves a runway *other* than the landing runway. Because such a procedure involves maneuvering from the final approach course to another runway, the minima for a circling approach are usually higher than those for a straight-in approach.

Approaches that don't meet specified criteria for runway alignment are designed as circling approaches only and are designated by the type of approach (VOR or NDB, for example) and a single letter (such as *B*). Each such approach to an airport is given a different letter, beginning with *A* and moving up the alphabet.

When you execute a circling approach, you may not depart from the published approach procedure until you have the runway in sight and are in a position from which a normal landing can be made.

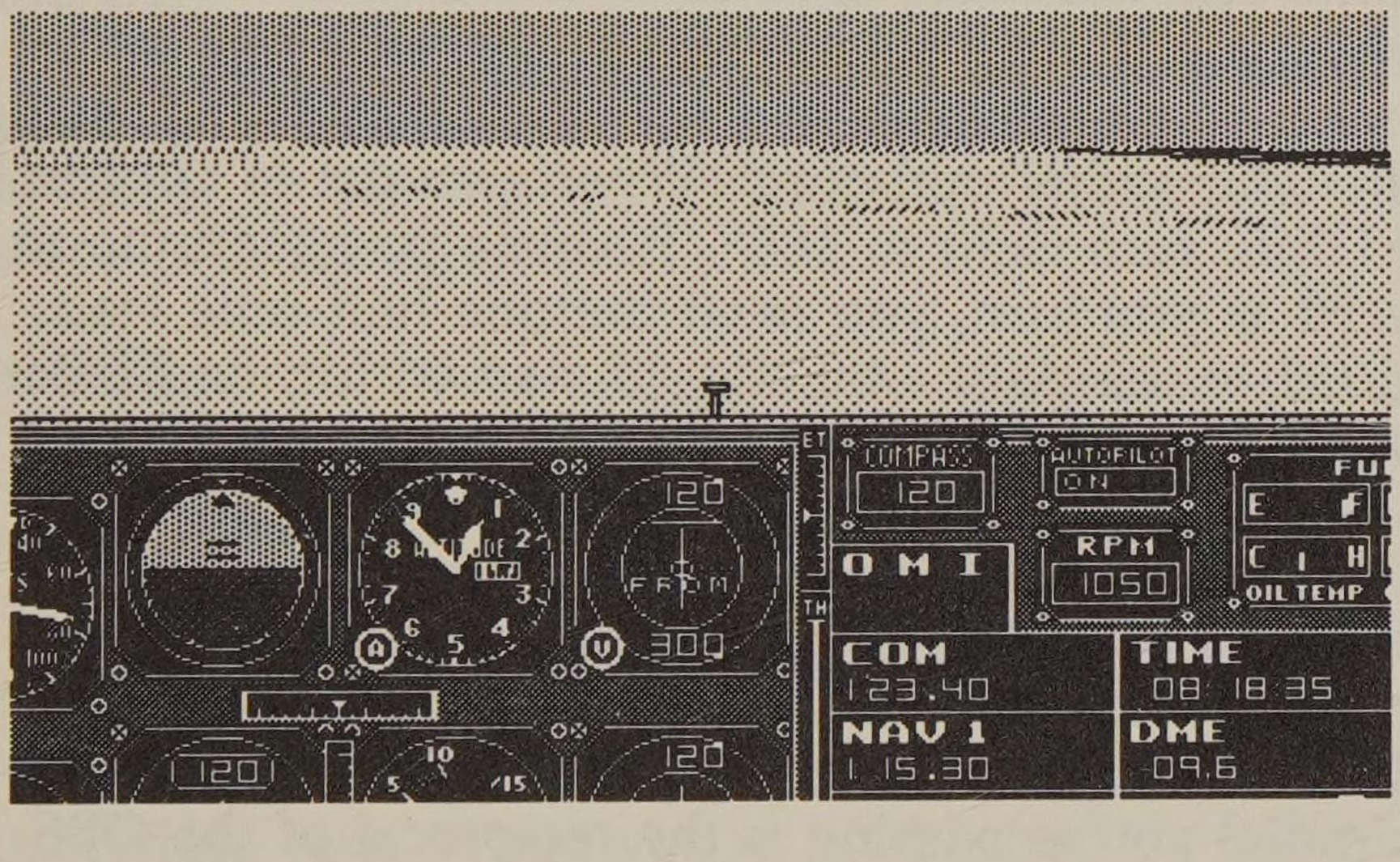
You should maneuver the airplane as close as possible to the airport. If, during the circling procedure, you lose sight of the airport, you must immediately execute the missed approach procedure. Because you have maneuvered off of the approach course, executing the missed approach procedure may require a left turn when a right is called for, or vice versa.

In this scenario, you're on the ground at Oceanside Municipal Airport in Southern California. After setting up your avionics for the published departure procedure (see Appendix A) and the VOR-A IAP to Carlsbad/McClellan-Palomar Airport (see Appendix B), take off and follow the published departure procedure.

Continue your climb to 3000 feet. When you cross the Oceanside VOR, turn left to 270°, and hold that heading for one minute. Then turn left at standard rate and re-intercept the 270° radial inbound (on a 90° course). When you cross the VOR, track the 120° radial outbound while descending to 1300 feet.

At the 7 DME fix, you can continue your descent to the circling minimum, 860 feet. As you descend through 900 feet, you should break out of the clouds and have the airport in sight. Choose the runway that you'll land on; then maneuver as close to the airport as possible to land on that runway.

Figure 8-3. At Circling Minimums—Airport in Sight



These instruments show an airplane at the circling minimums for Oceanside. The airport is barely visible in the distance (it may be more easily seen in your version of Flight Simulator).

DME Arcs

Begin this section with the following settings to *Flight Simulator*:

Cloud base	**2500**
North position	**16471**
East position	**16685**
Altitude	**695**

Some IAPs use a curved path instead of a straight course to lead into the final approach. One example of this can be found at the Danville Airport in Danville, Illinois.

That's where your airplane is sitting right now. If you look at the VOR/DME RWY 3 IAP chart to Danville (page 151 in Appendix B), you'll see that there are three IAFs. One is SOREZ intersection. The other two are at the ends of the 16 DME arc. If you begin the IAP from SOREZ, you must execute the procedure turn. If you begin on either end of the arc, however, you don't execute a procedure turn.

Take off from runway 3 and fly the runway heading until you intercept the Danville 085° radial. Climb and maintain 2300 feet. The clouds will be above you during the approach.

Track the 085° radial outbound. When you get to approximately 15.5 DME, turn right to 185°. Because you continue to travel eastward as you turn, you need the one-half-mile lead. By turning 100° to the right, you should stay within one mile of the arc.

Rotate the OBS all the way around until the needle centers with a *TO* indication. Keep the needle centered so that you can keep track of which radial you're on—turn the airplane every time you've traveled 10° to keep the airplane's heading 100° to the right of the radial you're passing. Remember that the radial you're passing is the reciprocal of the OBS setting when you have a *TO* indication. The reciprocal is the number on the bottom of the Omni-Bearing Indicator. In other words, your heading should be 100 greater than the radial shown on the bottom of the OBI—if the radial reads 195, for instance, then your heading should be 295°.

If the DME reading is greater than 16, make a correction to the right to get back on the arc. If the DME readout is less than 16, make a correction to the left.

As you approach the inbound course of 16°, time your turn so that you roll out on the inbound heading as the needle centers with the OBS set to 016°. When you're established on the inbound course, you're authorized to descend to 2200 feet. At SOREZ (DME 11), you can descend to 1300 feet. At 8.5 DME, you may descend to the MDA. The missed approach point is the Danville 6.3 DME.

ILS Approaches After Glideslope Fails

Begin this section with the following settings to *Flight Simulator*:

Cloud base	**1000**
North position	**21525**
East position	**6665**
Altitude	**603**

Occasionally, the glideslope transmitter on the ground isn't working, or the glideslope receiver in the aircraft fails. In such a situation, a localizer approach may be made in lieu of a full ILS IAP.

To simulate this situation, you have a choice. Either use your NAV-2 radio—which has no glideslope receiver—for the localizer, or use the NAV-1 radio and pretend that the glideslope is inoperative.

You're sitting on the ground at Snohomish County Airport in Everett, Washington. Study the ILS RWY 16 IAP to Everett. When you're ready, take off from runway 34 and track the localizer outbound while climbing to 3000 feet.

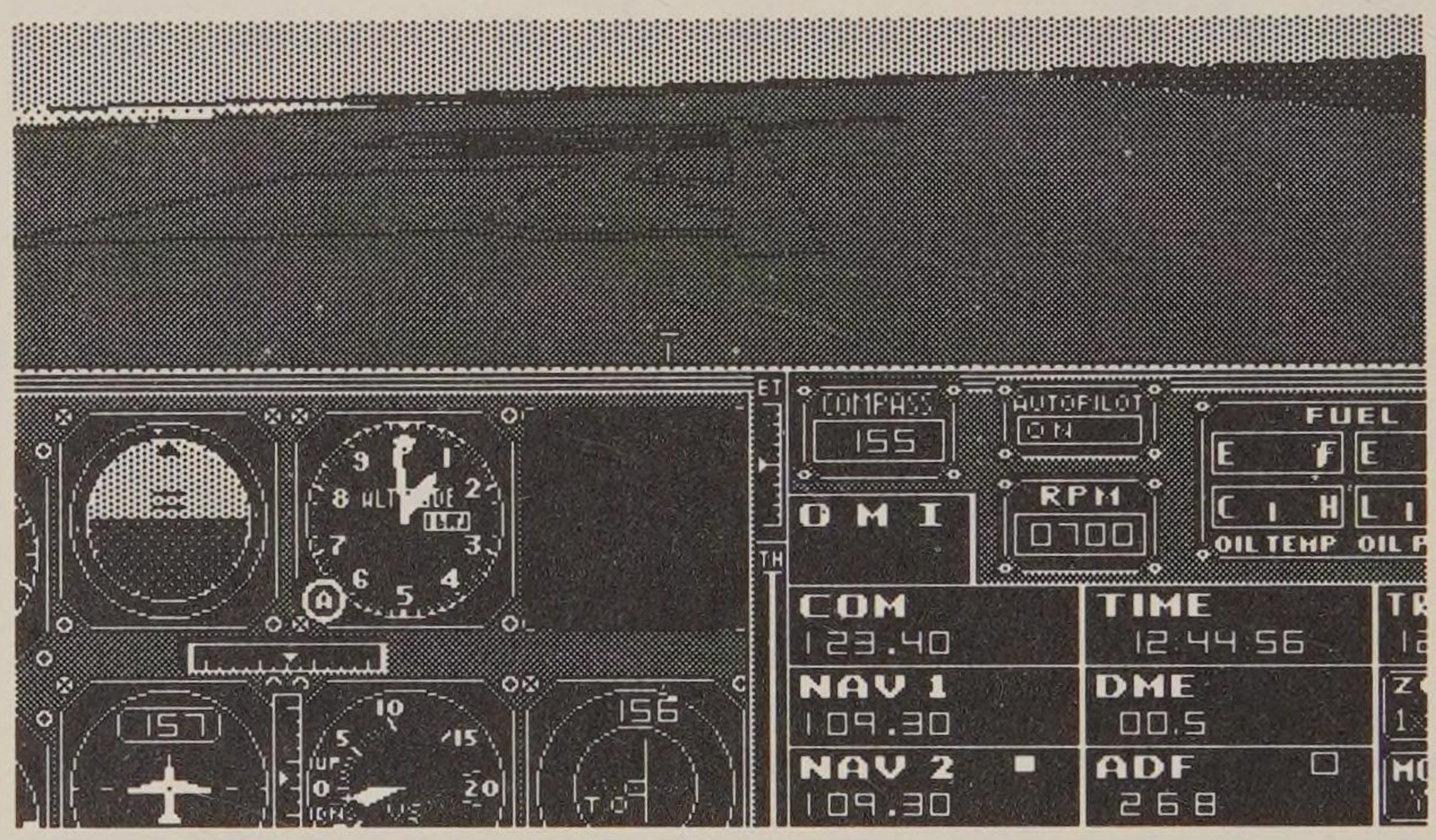
Track outbound past the outer marker and execute the procedure turn. When you're established on the inbound course, maintain 3000 feet until you cross the outer marker. Note the time that you cross the outer marker.

The missed approach point is determined by elapsed time on a localizer-only approach. The time-distance table at the bottom right of the IAP chart provides the times it will take to fly from the outer marker to the missed approach point at various groundspeeds. If your groundspeed is 90 knots, for example, it will take you 5 minutes and 12 seconds.

After crossing the outer marker, descend to 980 feet, the minimum descent altitude (not DH, since there's no glideslope) for localizer-only approaches (*S-LOC 16* in the minima section of the chart stands for straight-in localizer approach to runway 16).

Maintain 980 feet until you have the runway in sight and are in a position from which a normal landing can be made, or until your approach time runs out. Time should run out at about the same time you pass over the middle marker.

Figure 8-4. Failed Glideslope Receiver



You're at minimum descent altitude (MDA), but your glideslope receiver isn't working.

Radar Vectors to the Final Approach Course

Begin this section with the following settings to *Flight Simulator*:

Cloud base	**900**
North position	**17089**
East position	**21177**
Altitude	**81**

Some IAPs require an air traffic controller to provide radar vectors (or headings) to the final approach course. One example of this is the VOR RWY 31L to New York/John F. Kennedy International Airport.

Notice the *RADAR REQUIRED* note in the planview. There are no IAFs, because the only way to execute the approach is to receive radar vectors to the final approach course.

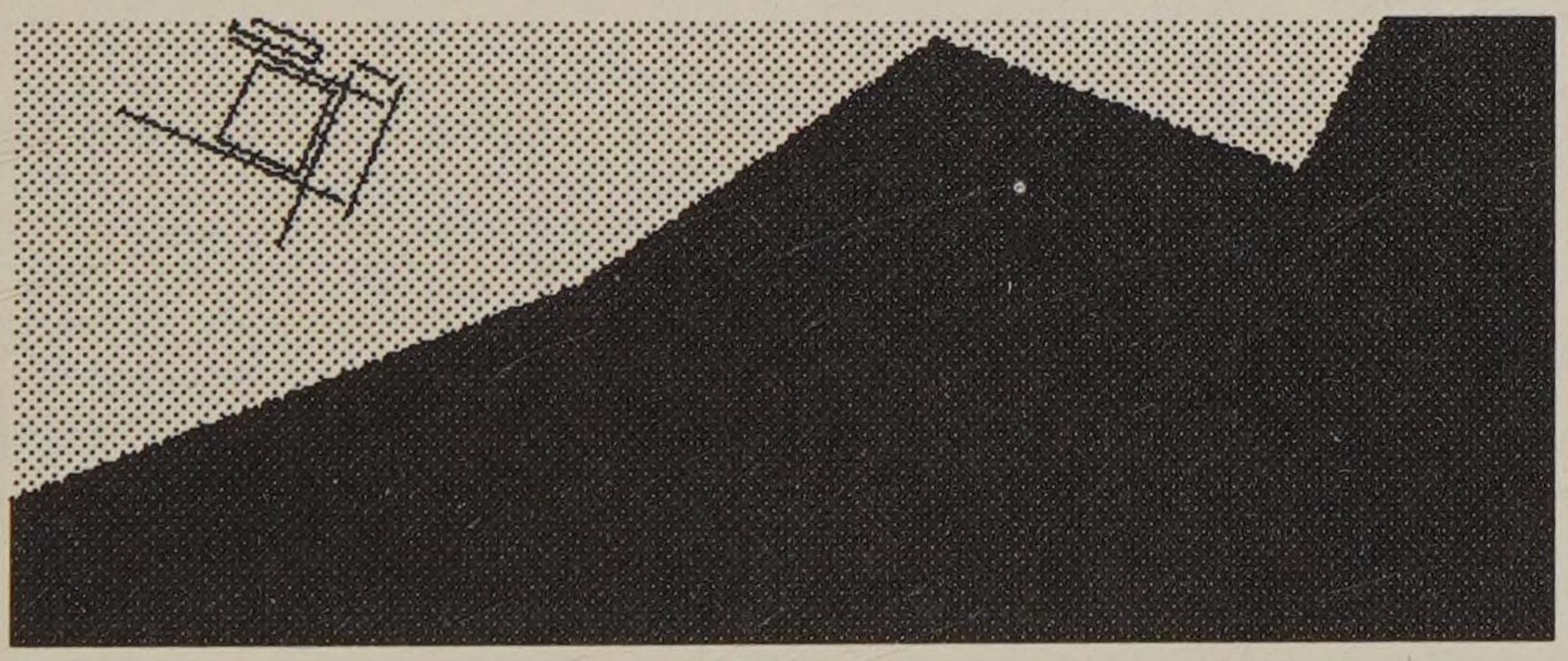
Unfortunately, *Flight Simulator* doesn't provide air traffic control services (other than the information provided on ATIS or on control tower frequencies). Fortunately, there is a way that you can play the role of a radar air traffic controller.

After you take off from Republic Airport, you can use the overhead, or map view, to view your airplane relative to the airport at which you're landing. Try assigning yourself headings that will place you on the final approach course outside the final approach fix. Ideally, your intercept heading should be within 30° of the final approach course.

To get yourself started, take off from Republic and intercept the 220° radial from Deer Park. Follow the radial with the map view selected until you can see the runway layout at Kennedy Airport. Begin giving yourself radar vectors.

Good luck in your new career as an air traffic controller!

Figure 8-5. Vectoring Yourself



This map (or overhead) view shows an airplane on a heading to join the final approach course into Kennedy.

Appendices

Appendix A

IFR Takeoff Minimums and Departure Procedures

These procedures are copied from publications produced by the U.S. Department of Commerce.

Changes, omissions, and format changes have been made for easier comprehension and compatibility with *Flight Simulator*.

These procedures *cannot* be used for actual navigation. They *do not* insure terrain or obstruction clearance in actual navigation.

> **Do not use for actual navigation. These materials are outdated and modified for use with *Flight Simulator*. Terrain and obstruction clearance are *not* insured.**

Avalon, CA

Catalina

Rwys 4 and 22: Climb straight ahead to 2300′; then proceed on course.

Block Island State, RI

Rwy 10: 300-1
Rwy 28: 300-1

Boston, MA

General Edward Lawrence Logan Intl

Rwy 27: 900-1
Rwy 15R: RVR/40*
Rwy 4R: 300-1 or standard (RVR/18 FAR 135) with minimum climb of 320′ per NM to 300′.

Rwy 4L: 300-1 or standard with a minimum climb of 340′ per NM to 300′.
Rwy 9: 300-1 or standard with a minimum climb of 230′ per NM to 300′.
Rwy 22R: 400-1 or 300-1 with minimum climb of 310′ per NM to 400′.
Rwy 22L: 300-1 or standard when control tower reports no tall vessels in departure area.
Rwy 33L: 500-1 or standard RVR/18 (Federal Air Regulation 135) with minimum climb of 250′ per NM to 500′.

* *Federal Air Regulation 135*

IFR Departure Procedure
Rwys 22L and 22R: Climb on runway heading to 700′ before turning right.
Rwy 33L: Climb runway heading to 700′ before turning left.

Bremerton National, WA

Rwys 1 and 34: Turn right; intercept and climb on 187° bearing from Kitsap NDB within 10 NM to cross Kitsap NDB northbound at 2000′.

Bridgeport, CT

Igor I. Sikorsky Memorial

Rwys 11, 16, and 34: 300-1
Rwy 29: 500-1

Carlsbad, CA

McClellan-Palomar

Rwy 6: 400-1 or standard with a minimum climb of 320′ per NM to 800′.

IFR Departure Procedure
Rwy 6: Climbing left turn heading 240°.
Rwy 24: Climb straight ahead.
Both departures climb to 1900′ before proceeding on course.

Chicago, IL

Chicago Midway

Rwys 4L, 4R, and 22R: 300-1
Rwy 13L: 300-1 or standard with minimum climb of 324′ per NM to 700′.
Rwy 13R: 300-1 or standard with minimum climb of 212′ per NM to 700′.
Rwy 31L: 300-1 or standard with minimum climb of 273′ per NM to 700′.
Rwy 22L: 300-1 or standard with minimum climb of 213′ per NM to 700′.

IFR Departure Procedure
Rwys 22L, 22R, 31L, and 31R: Climb runway heading to 1300′ before turning east.
Rwys 4L and 4R: Climb to 2400′ on heading 090° before turning north.
Rwys 13L/13R: Climb runway heading to 1300′ before turning.

Chicago-O'Hare Intl

Rwy 18: NA
Rwy 36: 500-1

IFR Departure Procedure
Rwy 32L: Climb runway heading to 1500′ before turning left when weather is below 1000-3.

Lansing Muni

Rwys 9 and 36: 300-1

IFR Departure Procedure
Rwys 9, 27, and 36: Climb runway heading to 2000′ before turning.

Chicago (West Chicago), IL

Du Page

IFR Departure Procedure
Rwys 4, 10, 15, 22, 28, and 33: Climb on runway heading to 1200′ before turning.

Chico Muni, CA

Rwy 13L: ¾ mile*

* *Federal Air Regulation 135*

IFR Departure Procedure

Rwy 13L/R: Turn right.
Rwy 31L/R: Turn left.
Climb to 3000′ or above on the Chico R-202. Then proceed on course.

Chino, CA

Rwy 3: 300-1
Rwy 21: 1200-2
Rwy 26 (northbound and eastbound): standard
Rwy 26 (westbound and southbound): 2700-2 or standard with a minimum climb of 220′ per NM to 4000′.

IFR Departure Procedure

Northbound and eastbound
Rwys 3 and 8: Turn right.
Rwys 26 and 21: Turn left.
Direct to Paradise VORTAC; cross Paradise VORTAC at or above 4000′.
Westbound and southbound
Rwy 3: Turn left.
Rwys 8, 21, and 26: Turn right.
Direct Pomona VORTAC; cross Pomona VORTAC at or above 5000′.

Columbia, CA

Rwy 17: 400-2 or standard with minimum climb of 210′ per NM to 3000′.
Rwy 35: 800-1½ or standard with minimum climb of 442′ per NM to 3000′.

IFR Departure Procedure

Rwy 17: Climb on 175° bearing from Columbia NDB to 3000′. Continue climbing right turn to 5000′ or above direct Columbia NDB.
Rwy 35: Climb on 355° bearing from Columbia NDB to 3000′. Continue climbing left turn to 5000′ or above direct Columbia NDB.

Concord, CA
Buchanan Field

Rwys 14L/R and 19L/R: 500-1. Climb direct Concord VOR. Minimum climb rate of 350′ per NM to 1000′ required.

Corona Muni, CA
Rwy 7: 1000-2
Rwy 25: 800-2

IFR Departure Procedure
Rwy 7: Turn left.
Rwy 25: Turn right.
Both to intercept Paradise VORTAC R-256 direct Paradise VORTAC. Cross Paradise VORTAC at or above 4000′.

Danbury Muni, CT
All Rwys: 700-1½

Danielson, CT
Rwy 13: 500-1
Rwy 31: 400-1

El Monte, CA
Rwy 1: 400-1
Rwy 19: 1100-2 or 400-1 with minimum climb of 250′ per NM to 1700′.

IFR Departure Procedure
Rwy 1: Climbing right turn; intercept Paradise R-276 to Paradise VORTAC.
Rwy 19: Climb runway heading to 800′; then climbing left turn to 4000′ intercept Paradise R-276 to Paradise VORTAC.
All aircraft cross Paradise VORTAC at or above 4000′.

Everett, WA
Snohomish County (Paine Field)

Rwy 16: RVR/24*

* *Federal Air Regulation 135*

Farmingdale, NY

Republic

Rwy 1: 200-1

IFR Departure Procedure
Rwy 1: Climb runway heading to 600′ before proceeding on course.
Rwy 32: Climb runway heading to 600′ before proceeding on course.

Frankfort, IL

Rwy 27: 300-1

IFR Departure Procedure
Rwy 9: Climb runway heading to 1200′ before turning northbound.

Fresno, CA

Fresno Air Terminal

Rwy 29R: RVR/24*

IFR Departure Procedure
Climb direct to Fresno VORTAC.

* *Federal Air Regulation 135*

Fresno-Chandler Downtown

Rwys 12L/R: Climb heading 165°.
Rwys 30L/R: Climb heading 345°.
Both to 1000′ before proceeding on course.

Hartford-Brainard, CT

Rwys 2, 11, and 20: 300-1

IFR Departure Procedure
Rwy 2: Climb to 800′ via runway heading before turning westbound.
Rwy 20: Climb to 1900′ via runway heading before turning westbound.
Rwy 11: Climb to 600′ via runway heading before turning westbound.

Rwy 29: Climbing left turn to 2100′ direct Hartford VORTAC before proceeding west or northwest bound.

Hawthorne Muni, CA

Rwy 7: 400-1
Rwy 25: 400-1 or standard with minimum climb of 280′ per NM to 400′.

IFR Departure Procedure
Rwy 7: Turn right; climb heading 240°.
Rwy 25: Turn left; climb heading 210°.
To 3000′ via Los Angeles R-170 to Los Angeles 10 DME. Then proceed on course.

Joliet Park District, IL

Rwy 12: 500-1
Rwy 22: 300-1

IFR Departure Procedure
Rwy 4: Climb to 1000′ before turning right.
Rwy 30: Climb to 1000′ before turning left.
Rwy 22: When ceiling is below 500′, climb to 1100′ before turning left.

Kankakee, IL

Greater Kankakee

Rwy 4: ½ mile*

** Federal Air Regulation 135*

Lodi, CA

Rwys 8, 12, 26, and 30: 300-1. Climb direct to Linden VORTAC.

Los Angeles Intl, CA

IFR Departure Procedure
Rwys 6L/R and 7L/R: Climb to 2000′ heading 070°; then turn right direct Seal Beach VORTAC.
Rwys 24L/R and 25L/R: Climb to 3000′ heading 250°; then turn left direct Seal Beach VORTAC.

Marysville, CA
Yuba County

IFR Departure Procedure
All rwys: Climb direct Williams VORTAC.

Merced Muni, CA
Rwy 30: ½ mile*

IFR Departure Procedure
Rwys 12 and 30: Climb to 2000′ direct Merced VOR.

* *Federal Air Regulation 135*

Meriden Markham Muni, CT
Rwy 36: 1200-1 or standard with minimum climb of 420′ per NM to 1300′.

IFR Departure Procedure
Rwy 18: Climb runway heading to 700′ before proceeding west or northbound.
Rwy 36: Climbing left turn to 1800′ via 325° bearing from Meriden NDB before proceeding on course.
Caution: Rapidly rising terrain 2.4 NM north of airport.

Modesto City-County Airport—Harry Sham Field, CA
Rwys 10L and 28L: 100-1 or standard with minimum climb of 300′ per NM to 300′.
Rwy 10R: 100-1 or standard with minimum climb of 350′ per NM to 300′.

IFR Departure Procedure
All rwys: Climb to 1000′ on runway heading before proceeding on course.

Napa County, CA
Rwys 6 and 36L/R: 700-1

IFR Departure Procedure
Rwy 6 and Rwys 18L/R: right turn
Rwy 24 and Rwy 36L/R: left turn
Direct to Scaggs Island VORTAC.

New Haven, CT
Tweed–New Haven

Rwys 2 and 20: 300-1
Rwy 32: 400-1
Rwy 14: 300-1

New York, NY
John F. Kennedy Intl

Rwy 13R: 300-1

La Guardia

Rwys 4 and 13: 400-1
Rwy 31: 400-1
Caution: Tall buildings and towers to 1749′ at 5.0 NM southwest of airport. Plan departure to avoid this area.

Oakland, CA
Metropolitan Oakland Intl

Rwy 11: RVR/24*
Rwy 29: RVR/18*

* *Federal Air Regulation 135*

IFR Departure Procedure
Rwys 9R, 9L, 11, 15, and 29: Turn right.
Rwy 33: Turn left.
Rwys 27L and 27R: Maintain runway heading.
Climb to 3000′ via Oakland R-288 to Oakland 15.5 DME. Then proceed on course.

Oceanside Muni, CA
Rwys 6 and 24: 400-1

IFR Departure Procedure
Rwy 6: Turn right.
Rwy 24: Turn left.
Climb to 1500′ heading 235°; then climbing right turn direct Oceanside VORTAC. Cross Oceanside VORTAC at or above 2500′.

Olympia, WA

Rwys 8, 26, and 35: 300-1
Rwy 17: 300-1

IFR Departure Procedure

Rwy 8: Turn left.
Rwys 17 and 26: Turn right.
Climb on Olympia VORTAC R-348 within 10 miles to cross Olympia VORTAC at or above 5400′.

Ontario Intl, CA

Rwys 8L/R: 1300-2 or standard with minimum climb of 230′ per NM to 2600′.
Rwys 3 and 21: 400-1

IFR Departure Procedure

Rwys 3 and 8L/R: Turn right as soon as practical.
Rwys 21 and 26L/R: Turn left.
All departures climb direct Paradise VORTAC. Departures on Paradise VORTAC R-105 CW R-140 or R-215 CW 295 climb on course. All others cross Paradise VORTAC at or above R-141 CW R-214, 3900; R-296 CW R-314, 4400; R-316 CW R-104, 6700.

Oroville Muni, CA

Rwy 1: 900 and 1½ or standard with a minimum climb of 300′ per NM to 1000′.

IFR Departure Procedure

Rwys 1 and 30: Turn left.
Rwys 12 and 19: Turn right.
Climb via Maxwell R-045 to 3000′ or above. Then proceed on course.

Oxford, CT

Waterbury-Oxford

Rwy 13: 300-1
Rwy 36: 300-1

IFR Departure Procedure

Rwy 13: Climb runway heading to 1400′ before turning eastbound.

Plainfield, IL
Clow Intl

IFR Departure Procedure
Rwy 36: Climb runway heading to 1100′ before turning left.

Red Bluff Muni, CA
IFR Departure Procedure
Climb along Red Bluff R-346 to 5000′. Then proceed on course.

Reno Cannon Intl, NV
Rwy 7: 1600-2
Rwy 16: 2500-2
Rwy 25 (Categories A and B): 1500-2
Rwy 25 (Categories C and D): 4000-3
Rwy 34: 1700-2

IFR Departure Procedure
Rwys 7 and 16: Turn left.
Rwy 25: Turn right.
Rwy 34: Climb to 8500′ heading 344° before proceeding on course.

Renton Muni, WA
Rwy 15: 700-1
Rwy 33: 700-1

IFR Departure Procedure
Rwy 33: Climb runway heading to 700′.
Rwy 15: Climb visually over the airport to 700′.
Then climb direct Seattle VORTAC. Aircraft departing on Seattle R-307 CW 011 or R-141 CW 227 climb on course. All others climb on R-227 within 10 NM to cross Seattle VORTAC at or above R-012 CW 101, 2000; R-102 CW 140, 9000; R-228 CW 306, 3000.

Riverside Muni, CA
Rwy 9: 1100-2 or standard with minimum climb of 235′ per NM to 2200′.
Rwy 16: NA
Rwy 27: standard

Rwy 34: 700-2 or 400-1 with minimum climb of 360′ per NM to 1600′.

IFR Departure Procedure
Rwy 9: Climb runway heading to 1300′; then climbing right turn to 4000′ direct Paradise VORTAC.
Rwy 34: Turn left.
Rwys 27 and 34: Climb heading 280° to 2000′; then climbing left turn to 4000′ direct Paradise VORTAC.

Romeoville, IL

Lewis University

Rwy 6: 400-1
Rwy 9: 300-1

IFR Departure Procedure
Rwys 9, 24, and 27: When weather is below 400-1, climb on runway heading to 1100′ before turning on course.

Sacramento, CA

Sacramento Executive

Rwy 2: ½ mile*
Rwy 12: 300-1

* *Federal Air Regulation 135*

IFR Departure Procedure
Climb direct to Sacramento VORTAC.

Salinas Muni, CA

Rwys 3, 14, 21, and 32: NA
Rwy 31: RVR/24*
Rwy 8 (Categories C and D): 3600-2 or standard with minimum climb of 420′ per NM to 4100′.
Rwy 13 (Categories C and D): 3600-2 or standard with minimum climb of 500′ per NM to 4000′.

* *Federal Air Regulation 135*

IFR Departure Procedure
Rwys 8, 13, and 26: Turn right.
Rwy 31: Turn left.
Climb on Salinas R-275 to 2000′; then climbing right turn to cross Salinas VORTAC at or above 3000′.

San Francisco Intl, CA

Rwys 28L and 28R: 1000-2 or standard with minimum climb of 300′ per NM to 1000′.
Rwy 19R (Categories A and B) and Rwy 19L: 1300-2 or standard with minimum climb of 480′ per NM to 1400′.
Rwy 19R (Categories C and D): 2100-2 or standard with minimum climb of 530′ per NM to 1800′.

IFR Departure Procedure

Rwys 1L/R and 28L/R: Climb runway heading to 2000′; then climb on course.
Rwys 19L/R: Climbing left turn to 2000′ to intercept San Francisco R-090; then climb on course.
Rwys 10L/R: Climb to 2000′ via San Francisco R-09 0; then climb on course.

San Jose Intl, CA

Rwys 11, 12R, and 12L: 400-1 or standard with climb of 225′ per NM to 500′.

IFR Departure Procedure

Rwys 29, 30L, and 30R: Climb direct Oakland VORTAC.
Rwys 11, 12L, and 12R: Climbing right turn direct Oakland VORTAC.

Santa Ana, CA

John Wayne Airport—Orange County

Rwy 19L: 400-1
Rwy 19R: RVR/24*

* *Federal Air Regulation 135*

IFR Departure Procedure

Rwys 1L and 1R: Climb runway heading to 700′; climbing left turn to 2000′, direct Seal Beach VORTAC.
Rwys 19L and 19R: Climb runway heading to 500′; climbing left turn to 2000′ on Santa Ana R-190; then climb on course.
When control zone not in effect, reduction NA.

Santa Monica Muni, CA

Rwy 3: 800-1

IFR Departure Procedure
Rwy 3: Climb runway heading to 1100′; turn right direct Santa Monica VOR.
All aircraft proceed via Santa Monica R-261 to Santa Monica 15 DME.

Santa Rosa, CA

Sonoma County
Rwy 1: 1100-3 or standard with minimum climb of 235′ per NM to 1100′.

IFR Departure Procedure
Rwy 1: Turn left.
Rwy 14: Turn right.
Rwy 19: Climb straight ahead.
Rwy 32: Climb straight ahead to 1800′; climbing left turn direct Santa Rosa VOR.
Intercept and climb southbound on R-200 Santa Rosa VOR within 15 miles to recross Santa Rosa VOR at or above 5900′.

Seattle, WA

Seattle-Tacoma Intl

Rwy 16R: RVR/18*
Rwy 34R: RVR/24*

** Federal Air Regulation 135*

IFR Departure Procedure
Aircraft departing on Seattle VORTAC R-307 CW 011 or R-141 CW 227 climb on course.
All others climb on R-227 within 10 NM to cross Seattle VORTAC at or above R-012 CW 101, 2000; R-102 CW 140, 9000; R-228 CW 306, 3000.

Boeing Field/King County Intl

Rwys 13L/R: 500-1
Rwys 31L/R: 600-1

IFR Departure Procedure
Climb visually over the airport to 300′, then direct to Seattle VORTAC.

Aircraft departing on Seattle R-307 CW 011 or R-141 CW 227 climb on course.
All others climb on R-227 within 10 NM to cross Seattle VORTAC at or above R-012 CW 101, 2000; R-102 CW 140, 9000; R-228 CW 306, 3000.

Shelton, WA
Sanderson Field

Rwys 5 and 23: 500-1

IFR Departure Procedure
Climb visually over the airport to 700', then direct Mason County NDB before proceeding on course.

South Lake Tahoe, CA
Lake Tahoe

Rwy 18: 1200-3*
Rwy 36: Standard*
Night takeoff Rwy 18 not authorized.

** Minimum climb of 350' per NM to 9000' required.*

IFR Departure Procedure
Rwy 18: Turn right; climb visually within 2 NM to cross airport heading 330°.
Rwy 36: Left turn heading 330°.
To intercept Lake Tahoe R-115 to Lake Tahoe VORTAC.

Southbridge Muni, MA
Rwys 2 and 20: 300-1

Tacoma Narrows, WA
Rwy 17: ½ mile*
Rwys 17 and 35: Maneuvering east of the airport not authorized.

** Federal Air Regulation 135*

Torrance Muni, CA
Rwys 11L/R: 400-1 or standard with a minimum climb of 325' per NM to 500'.

IFR Departure Procedure
Rwys 29L/R: Climb runway heading.
Rwys 11L/R: Climbing left turn to heading 290°.
Both departures: Climb to 3000′; intercept Los Angeles R-170 to Los Angeles 10 DME.

Van Nuys, CA

Rwys 16L/R and 34L/R: 2500-2 or standard with minimum climb of 270′ per NM to 3500′.

IFR Departure Procedure
Rwys 16L/R: climbing left turn
Rwys 34L/R: climbing right turn
To intercept Van Nuys R-096 to Van Nuys 10 DME

Visalia Muni, CA

IFR Departure Procedure
Rwy 30: Turn left.
Rwy 12: Turn right.
Climb heading 230° to 2000′.

Watsonville Muni, CA

Rwy 1: 1800-2 or standard with minimum climb of 370′ per NM to 2000′.
Rwy 26: 400-1 or standard with minimum climb of 230′ per NM to 600′.

IFR Departure Procedure
Rwys 1 and 8: Turn right.
Rwy 26: Turn left.
All aircraft proceed direct Pajar NDB and follow Pajar NDB bearing 196° while climbing to 4000′. Then proceed on course.

White Plains, NY

Westchester County

Rwys 11 and 29: 300-1
Rwy 16: 300-1

Willimantic, CT

Windham

Rwys 6, 18, 27, and 36: 300-1
Rwy 9: 700-1
Rwy 24: 500-1

Willows–Glenn County, CA

Climb direct to Maxwell VORTAC.

Windsor Locks, CT

Bradley Intl

Rwy 15: 300-1
Rwy 33: 700-1

IFR Departure Procedure

Rwy 1: Climb to 1000′ via runway heading before turning westbound.

Appendix B

Selected IAP Charts for *Flight Simulator*

List of IAP Charts

Airport	City	State	Approach	Page #
Aurora Muni	Aurora	IL	VOR-A	114
Aurora Muni	Aurora	IL	VOR RWY 36	115
Avalon/Catalina	Avalon	CA	VOR-A	116
Avalon/Catalina	Avalon	CA	VOR/DME-B	117
Block Island State	Block Island	RI	NDB RWY 10	118
Bloomington-Normal	Bloomington-Normal	IL	VOR RWY 11	119
Bloomington-Normal	Bloomington-Normal	IL	VOR RWY 21	120
Bloomington-Normal	Bloomington-Normal	IL	VOR/DME RWY 21	121
Boston/General Edward Lawrence Logan Intl	Boston	MA	VOR/DME RWY 15R	122
Boston/General Edward Lawrence Logan Intl	Boston	MA	VOR/DME RWY 27	123
Boston/General Edward Lawrence Logan Intl	Boston	MA	VOR/DME RWY 33L	124
Bremerton National	Bremerton	WA	NDB RWY 1	125
Bridgeport/Igor I. Sikorsky Mem	Bridgeport	CT	VOR RWY 6	126
Bridgeport/Igor I. Sikorsky Mem	Bridgeport	CT	VOR RWY 24	127
Carlsbad/McClellan-Palomar	Carlsbad	CA	NDB RWY 24	128
Carlsbad/McClellan-Palomar	Carlsbad	CA	VOR-A	129
Champaign-Urbana	Champaign-Urbana	IL	NDB RWY 32	130
Champaign-Urbana	Champaign-Urbana	IL	ILS RWY 32	131
Champaign-Urbana	Champaign-Urbana	IL	LOC BC RWY 14	132
Champaign-Urbana	Champaign-Urbana	IL	VOR RWY 4	133
Champaign-Urbana	Champaign-Urbana	IL	VOR/DME RWY 22	134
Chester	Chester	CT	VOR-A	135
Chicago Midway	Chicago	IL	NDB RWY 4R	136
Chicago-O'Hare International	Chicago	IL	VOR RWY 22R	137
Chicago/Du Page	Chicago	IL	VOR RWY 10	138
Chicago/Lansing Muni	Chicago	IL	VOR-A	139
Chicago/Merrill C. Meigs	Chicago	IL	Shore VA RWY 36	140
Chico Muni	Chico	CA	VOR RWY 13L	141
Chico Muni	Chico	CA	VOR RWY 31R	142
Chico Muni	Chico	CA	VOR/DME RWY 13L	143
Chino	Chino	CA	NDB-C	144
Columbia	Columbia	CA	NDB-A	145
Concord/Buchanan Fld	Concord	CA	VOR RWY 19R	146
Corona Muni	Corona	CA	VOR-A	147
Danbury Muni	Danbury	CT	VOR-A	148
Danielson	Danielson	CT	VOR-A	149
Danville/Vermilion Co	Danville	IL	VOR RWY 21	150
Danville/Vermilion Co	Danville	IL	VOR/DME RWY 3	151
Dwight	Dwight	IL	NDB RWY 27	152
El Monte	El Monte	CA	NDB-C	153
El Monte	El Monte	CA	VOR-A	154
El Monte	El Monte	CA	VOR/DME-B	155

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Everett/Snohomish Co	Everett	WA	ILS RWY 16	156
Everett/Snohomish Co	Everett	WA	VOR RWY 16	157
Everett/Snohomish Co	Everett	WA	VOR RWY 34	158
Farmingdale/Republic	Farmingdale	NY	NDB RWY 1	159
Frankfort	Frankfort	IL	VOR RWY 27	160
Fresno Air Terminal	Fresno	CA	VOR RWY 11L	161
Fresno-Chandler Downtown	Fresno	CA	NDB-B	162
Fresno-Chandler Downtown	Fresno	CA	VOR/DME-C	163
Gibson City Muni	Gibson City	IL	VOR-A	164
Hartford-Brainard	Hartford	CT	VOR-A	165
Hawthorne Muni	Hawthorne	CA	VOR RWY 25	166
Joliet Park District	Joliet	IL	VOR RWY 12	167
Kankakee/Greater Kankakee	Kankakee	IL	VOR RWY 4	168
Kankakee/Greater Kankakee	Kankakee	IL	VOR RWY 22	169
Lodi	Lodi	CA	VOR-A	170
Los Angeles International	Los Angeles	CA	VOR RWY 7L/R	171
Los Angeles International	Los Angeles	CA	VOR RWY 25L/R	172
Martha's Vineyard	Martha's Vineyard	MA	ILS RWY 24	173
Martha's Vineyard	Martha's Vineyard	MA	VOR RWY 6	174
Martha's Vineyard	Martha's Vineyard	MA	VOR RWY 24	175
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Merced Muni	Merced	CA	VOR RWY 30	178
Meriden Markham Muni	Meriden	CT	NDB RWY 36	179
Meriden Markham Muni	Meriden	CT	VOR RWY 36	180
Modesto City-County Airport-Harry Sham Field	Modesto	CA	VOR RWY 28R	181
Monee/Sanger	Monee	IL	VOR RWY 5	182
Morris Muni	Morris	IL	VOR-A	183
Napa County	Napa	CA	VOR RWY 6	184
New Haven/Tweed-New Haven	New Haven	CT	VOR RWY 2	185
New Haven/Tweed-New Haven	New Haven	CT	VOR RWY 20	186
NY/John F. Kennedy Intl	NY	NY	VOR-D	187
NY/John F. Kennedy Intl	NY	NY	VOR RWY 4L/R	188
NY/John F. Kennedy Intl	NY	NY	VOR RWY 31L	189
NY/John F. Kennedy Intl	NY	NY	VOR/DME RWY 22L	190
NY/La Guardia	NY	NY	VOR-A	191
NY/La Guardia	NY	NY	VOR-B	192
NY/La Guardia	NY	NY	VOR-C	193
NY/La Guardia	NY	NY	VOR RWY 4	194
Oakland/Metropolitan Oakland Intl	Oakland	CA	ILS RWY 11	195
Oakland/Metropolitan Oakland Intl	Oakland	CA	VOR RWY 9R	196
Oakland/Metropolitan Oakland Intl	Oakland	CA	VOR/DME RWY 27L	197
Oceanside Muni	Oceanside	CA	VOR-A	198
Olympia	Olympia	WA	VOR RWY 17	199
Olympia	Olympia	WA	VOR/DME RWY 35	200
Ontario International	Ontario	CA	VOR RWY 26R	201
Oroville Muni	Oroville	CA	VOR-A	202
Oxford/Waterbury-Oxford	Oxford	CT	NDB RWY 18	203
Plainfield/Clow Intl	Plainfield	IL	VOR-A	204
Red Bluff Muni	Red Bluff	CA	VOR RWY 33	205
Red Bluff Muni	Red Bluff	CA	VOR/DME RWY 15	206
Reno Cannon Intl	Reno	NV	NDB RWY 16R	207
Reno Cannon Intl	Reno	NV	VOR-D	208
Renton Muni	Renton	WA	NDB RWY 15	209
Romeoville/Lewis University	Romeoville	IL	VOR RWY 9	210

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Sacramento Executive	Sacramento	CA	VOR RWY 2	211
Salinas Muni	Salinas	CA	VOR RWY 13	212
San Francisco Intl	San Francisco	CA	VOR-B	213
San Francisco Intl	San Francisco	CA	VOR RWY 19L	214
San Jose Intl	San Jose	CA	VOR RWY 12L/R	215
Santa Ana/John Wayne Arpt–Orange Co	Santa Ana	CA	VOR RWY 1L	216
Santa Ana/John Wayne Arpt–Orange Co	Santa Ana	CA	VOR RWY 19R	217
Santa Monica Muni	Santa Monica	CA	VOR-A	218
Santa Rosa/Sonoma County	Santa Rosa	CA	VOR RWY 32	219
Seattle–Tacoma Intl	Seattle	WA	VOR RWY 16L/R	220
Seattle–Tacoma Intl	Seattle	WA	VOR RWY 34L/R	221
Seattle/Boeing Field/King County Intl	Seattle	WA	NDB-A	222
Shelton/Sanderson Fld	Shelton	WA	NDB RWY 23	223
South Lake Tahoe/Lake Tahoe	South Lake Tahoe	CA	VOR/DME-A	224
Southbridge Muni	Southbridge	MA	VOR-A	225
Southbridge Muni	Southbridge	MA	VOR/DME-B	226
Stockton Metropolitan	Stockton	CA	VOR RWY 29R	227
Tacoma Narrows	Tacoma	WA	NDB RWY 35	228
Torrance Muni	Torrance	CA	VOR RWY 11L	229
Urbana/Frasca Fld	Urbana	IL	VOR-A	230
Urbana/Frasca Fld	Urbana	IL	VOR/DME-B	231
Van Nuys	Van Nuys	CA	ILS RWY 16R	232
Van Nuys	Van Nuys	CA	VOR-A	233
Van Nuys	Van Nuys	CA	VOR/DME-B	234
Visalia Muni	Visalia	CA	VOR RWY 12	235
Watsonville Muni	Watsonville	CA	NDB-B	236
Watsonville Muni	Watsonville	CA	VOR/DME-A	237
White Plains/Westchester Co	White Plains	NY	VOR/DME-A	238
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Willows–Glenn County	Willows	CA	VOR/DME RWY 34	241
Windsor Locks/Bradley Intl	Windsor Locks	CT	NDB RWY 6	242

Appendix B

GENERAL INFORMATION & ABBREVIATIONS

★ Indicates control tower or ATIS operates non-continuously.
Distances in nautical miles (except visibility in statute miles and Runway Visual Range in hundreds of feet).
Runway Dimensions in feet.
Elevations in feet Mean Sea Level (MSL).
Ceilings in feet above airport elevation.
Radials/bearings/headings/courses are magnetic.
# Indicates control tower temporarily closed UFN.

ADF ..... Automatic Direction Finder
ALS ..... Approach Light System
APP CON ..... Approach Control
ARR ..... Arrival
ASR/PAR ..... Published Radar Minimums at this Airport
ATIS ..... Automatic Terminal Information Service
AWOS ..... Automated Weather Observing System
AZ ..... Azimuth
BC ..... Back Course
C ..... Circling
CAT ..... Category
CCW ..... Counter Clockwise
Chan ..... Channel
CLNC DEL ..... clearance delivery
CTAF ..... Common Traffic Advisory Frequency
CW ..... Clockwise
DH ..... Decision Height
DME ..... Distance Measuring Equipment
DR ..... Dead Reckoning
ELEV ..... elevation
FAF ..... Final Approach Fix
FM ..... Fan Marker
GPI ..... Ground Point of Intercept(ion)
GS ..... Glide Slope
HAA ..... Height Above Aiport
HAL ..... Height Above Landing
HAT ..... Height Above Touchdown
HIRL ..... High Intensity Runway Lights
IAF ..... Initial Approach Fix
ICAO ..... International Civil Aviation Organization
IM ..... Inner Marker
Intcp ..... Intercept
INT ..... Intersection
LDA ..... Localizer Type Directional Aid
Ldg ..... Landing
LDIN ..... Lead in Light System
LIRL ..... Low Intensity Runway Lights
LOC ..... Localizer
LR ..... Lead Radial. Provides at least 2 NM (Copter 1 NM) of lead to assist in turning onto the intermediate/final course
MALS ..... Medium Intensity Approach Light System
MALSR ..... Medium Intensity Approach Light Systems with RAIL
MAP ..... Missed Approach Point
MDA ..... Minimum Descent Altitude
MIRL ..... Medium Intensity Runways Lights
MLS ..... Microwave Landing System
MM ..... Middle Marker
NA ..... Not Authorized
NDB ..... Non-directional Radio Beacon
NM ..... Nautical Miles
NoPT ..... No Procedure Turn Required (Procedure Turn shall not be executed without ATC clearance)
ODALS ..... Omnidirectional Approach Light System
OM ..... Outer Marker
R ..... Radial
RA ..... Radio Altimeter setting height
Radar Required ..... Radar vectoring required for this approach
RAIL ..... Runway Alignment Indicator Lights
REIL ..... Runway End Identifier Lights
RNAV ..... Area Navigation
RPI ..... Runway Point of Intercept
RRL ..... Runway Remaining Lights
Runway Touchdown Zone ..... First 3000′ of Runway
RVR ..... Runway Visual Range
S ..... Straight-in
SALS ..... Short Approach Light System
SSALR ..... Simplified Short Approach Light System with RAIL
SDF ..... Simplified Directional Facility
TA ..... Transition Altitude
TAC ..... TACAN
TCH ..... Threshold Crossing Height (height in feet Above Ground Level)
TDZ ..... Touchdown Zone
TDZE ..... Touchdown Zone Elevation
TDZ/CL ..... Touchdown Zone and Runway Centerline Lighting
TLv ..... Transition Level
VASI ..... Visual Approach Slope Indicator
VDP ..... Visual Descent Point
WPT ..... Waypoint (RNAV)
X ..... Radar Only Frequency

RADIO CONTROL AIRPORT LIGHTING SYSTEM

KEY MIKE	FUNCTION
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-off)

Available systems will be indicated on Instrument Approach Procedure (IAP) Charts, below the Minimums Data, as follows:
ACTIVATE MIRL Rwy 36-UNICOM.
ACTIVATE MIRL Rwy 36-122.8, ACTIVATE MALSR Rwy 7-122.8
ACTIVATE VASI and REIL Rwy 7-122.8, ACTIVATE HIRL Rwy 7-25 – 122.8

Appendix B

LEGEND
INSTRUMENT APPROACH PROCEDURES (CHARTS)

PLANVIEW SYMBOLS

TERMINAL ROUTES

Procedure Track

Missed Approach

Visual Flight Path

165° / 345°
Procedure Turn
(Type degree and point of turn optional)

3100 NoPT 5.6 NM to GS Intcpt
045°
(14.2 to LOM)
Minimum Altitude

2000
155°
Feeder Route
(15.1) Mileage
Penetrates Special Use Airspace

HOLDING PATTERNS

270° / 090°
In lieu of Procedure Turn

360° / 180°
Arrival Holding Pattern

360° / 180°
Missed Approach Holding

Limits will only be specified when they deviate from the standard. DME fixes may be shown.

REPORTING POINT/FIXES

Reporting Point

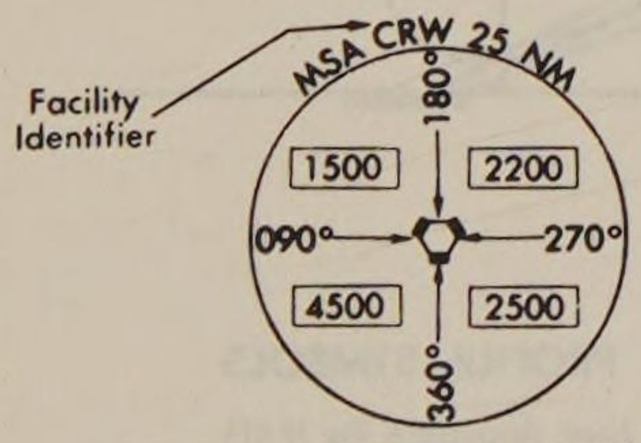
▲ Name (Compulsory)
△ Name (Non-Compulsory)

Fix or intersection

ARC/DME/RNAV Fix

R-198 → Radial line and value
LR-198 → Lead Radial

MINIMUM SAFE ALTITUDE (MSA)



(Arrows on distance circle identify sectors)

OBSTACLES

• Spot Elevation
• Highest Spot Elevation
Obstacle
Group of Obstacles
Highest Obstacle
± Doubtful Accuracy

SPECIAL USE AIRSPACE

R-352
R-Restricted
P-Prohibited
W-Warning
A-Alert

RADIO AIDS TO NAVIGATION

110.1 Underline indicates No Voice transmitted on this frequency

VOR VOR/DME TACAN VORTAC

NDB NDB/DME

LOM (Compass locator at Outer Marker)

Marker Beacon

Localizer (LOC/LDA) Course

SDF Course

MLS +10° (L)
MLS 00° (R/L)
180°
MLS −10° (R) MLS Approach Azimuth Coverage

MLS Identifier

MICROWAVE
Chan 514
M-VDZ
Glidepath 6.20°
Azimuth 01° (R)
DME 111.5 Chan 48 (Y)

LOC/DME

LOC/LDA/SDF/MLS Transmitter (shown when installation is offset from its normal position off the end of the runway.

Waypoint (WPT)

Waypoint Data

PRAYS
38°58.3'N 89°51.5'W
112.7 CAP 187.1°-56.2
590

Waypoint Name,
Coordinates,
Frequency, Identifier, Radial/Distance
(Facility to Waypoint)
Reference Facility Elevation

Primary Nav Aid with INS data

LIMA
114.5 LIM
Chan 92
12°00.80'S
77°07.00'W

Secondary Nav Aid

LMM
LIMA
248 NT

MISCELLANEOUS

VOR Changeover Point

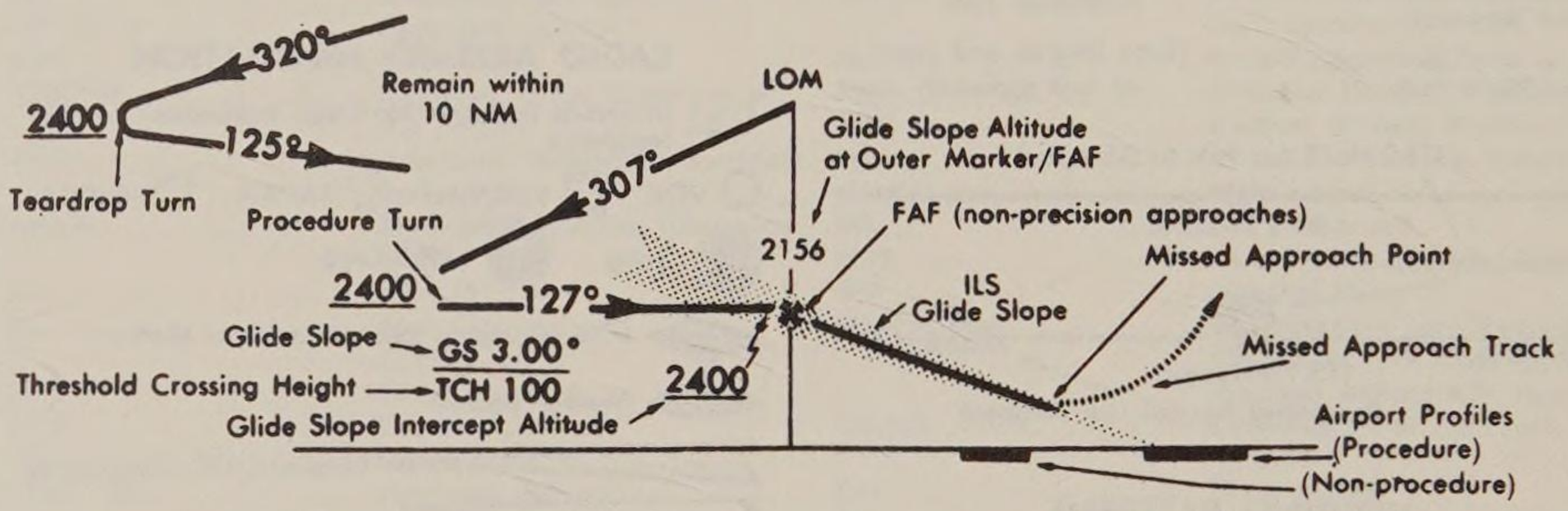
Distance not to scale

International Boundary

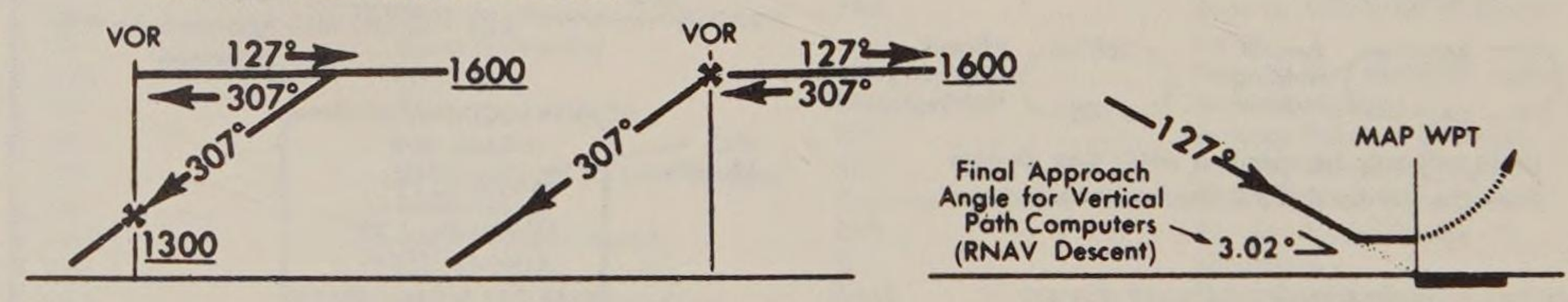
Appendix B

LEGEND
INSTRUMENT APPROACH PROCEDURES (CHARTS)

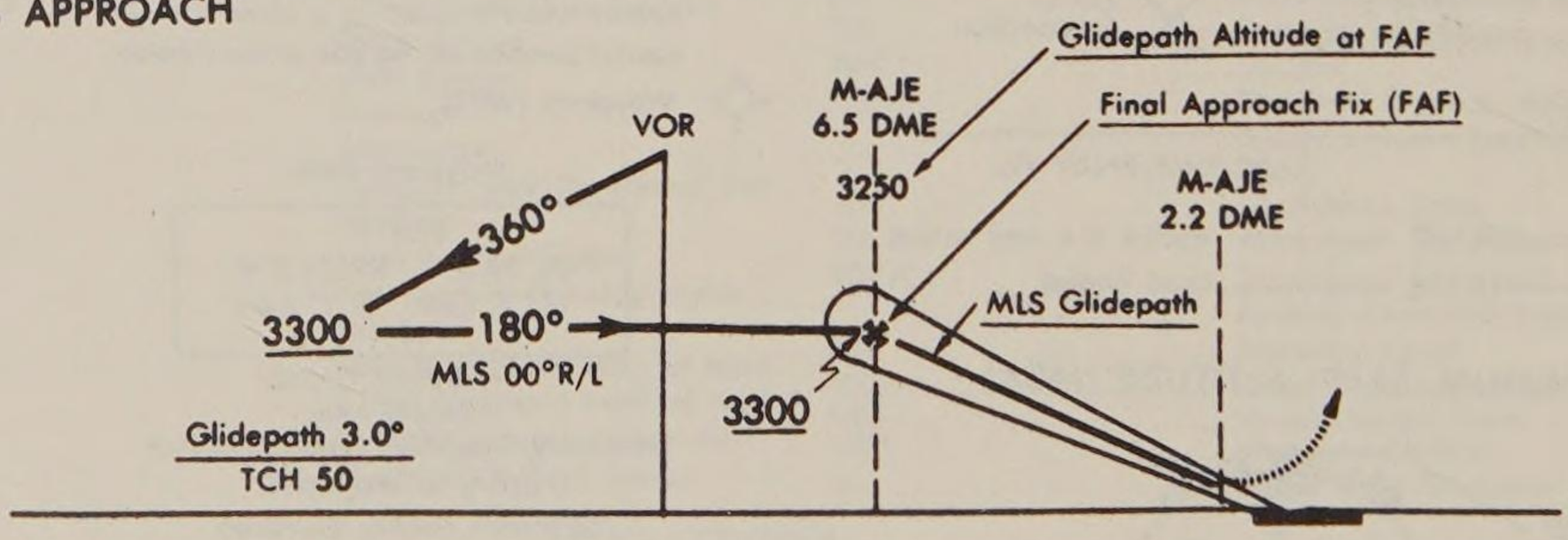
PROFILE



DESCENT FROM HOLDING PATTERN



MLS APPROACH



FACILITIES/FIXES

FM
IM
MM
NDB
OM
VOR
VORTAC
TACAN
WPT

FIX
INT

ALTITUDES

5500 Mandatory Altitude

2500 Minimum Altitude

4300 Maximum Altitude

3000 Recommended Altitude

PROFILE SYMBOLS

✖ Final Approach Fix (FAF) (for non-precision approaches)

Glide Slope/Glide Path Intercept Altitude and Final Approach Fix for precision approaches. Unless otherwise indicated the non-precision final approach altitudes is to be maintained until the next fix.

Visual Descent Point (VDP)

Visual Flight Path

Appendix B

LEGEND

INSTRUMENT APPROACH PROCEDURES (CHARTS)

AIRPORT SKETCH

Runways

Hard Surface

Other Than Hard Surface

Hardstands/Taxiways

Closed Runways

Under Construction

Metal Surface

Over-run

Displaced Threshold

Runway Centerline Lighting

Arresting Gear

uni-directional

bi-directional

Jet Barrier

- Control Tower
  When Control Tower and Rotating Beacon are co-located, Beacon symbol will be used and further identified as TWR.

★ Rotating Airport Beacon

Helicopter Alighting Areas

Negative Symbols used to identify Copter Procedure landing point.

Note: The prop type symbol is being phased out.

TDZE 123 Runway TDZ elevation

0.8% → UP Total Runway Gradient
(shown when runway gradient exceeds 0.3%)

- U.S. Navy Optical Landing System (OLS) "OLS" location is shown because of its height of approximately 7 feet and proximity to edge of runway may create on obstruction for some types of aircraft.

Approach light symbols are shown on a separate legend.

MINIMA DATA

A Alternate Minimums not standard.
Civil users refer to tabulation.
USA/USN/USAF pilots refer to appropriate regulations.

ANA Alternate minimums are Not Authorized due to unmonitored facility or absence of weather reporting service.

T Take-off Minimums not standard and/or Departure Procedures are published. Refer to tabulation.

Appendix B

LEGEND

AIRPORT DIAGRAMS

GENERAL INFORMATION (NOS)

SCOPE

Airport diagrams are specifically designed to assist in the movement of ground traffic at locations with complex runway/taxiway configurations and provide information for updating Inertial Navigation Systems (INS) aboard aircraft. Airport diagrams are not intended to be used for approach and landing or departure operations. Requisition for the creation of airport diagrams must meet the above criteria and will be approved by the FAA or DOD on a case-by-case basis.

NEW REQUIREMENTS/CORRECTIONS

National Ocean Service, NOAA, N/CG31
6010 Executive Boulevard
Rockville, Maryland 20852

Federal Aviation Administration, ATO-250
800 Independence Avenue, S.W.
Washington, D.C. 20591

LEGEND

Airport diagram scales are variable.

True/magnetic North orientation may vary from diagram to diagram.

Coordinate values are shown in one (1) minute increments. They are further broken down into six (6) second ticks, within each one (1) minute increment.

NOTE:
All new and revised airport diagrams are shown referenced to the World Geodetic System (WGS) (noted on appropriate diagram), and may not be compatible with local coordinates published in FLIP.

Arresting Gear

uni-directional bi-directional Jet Barrier

REFERENCE FEATURES

Buildings
Tanks
Obstruction
Airport Beacon
Runway Radar Reflectors
Control Tower
Helicopter Alighting Areas
Negative Symbols used to identify Copter Procedures landing point

TAXIWAY/RUNWAY DATA

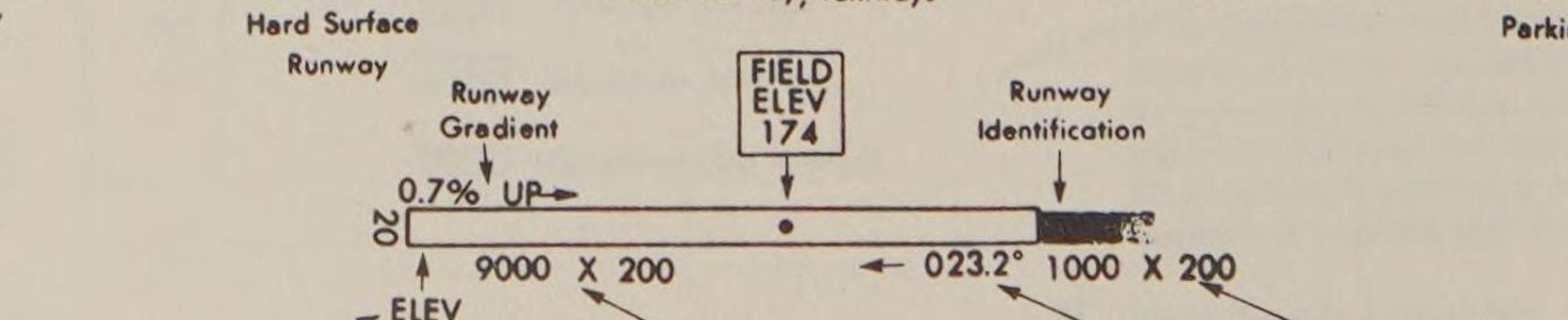
Hard Surface Runway

Other Than Hard Surface Runway

Closed Runway, Taxiways

Under Construction

Overruns, Taxiways, Parking Areas



Appendix B

INSTRUMENT APPROACH PROCEDURE CHARTS
RATE OF DESCENT TABLE
(ft. per min.)

A rate of descent table is provided for use in planning and executing precision descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, attitude combination can be programmed which will result in a stable glide rate and attitude favorable for executing a landing if minimums exist upon breakout. Care should always be exercised so that the minimum descent altitude and missed approach point are not exceeded.

ANGLE OF DESCENT (degrees and tenths)	GROUND SPEED (knots)										
	30	45	60	75	90	105	120	135	150	165	180
2.0	105	160	210	265	320	370	425	475	530	585	635
2.5	130	200	265	330	395	465	530	595	665	730	795
3.0	160	240	320	395	480	555	635	715	795	875	955
3.5	185	280	370	465	555	650	740	835	925	1020	1110
4.0	210	315	425	530	635	740	845	955	1060	1165	1270
4.5	240	355	475	595	715	835	955	1075	1190	1310	1430
5.0	265	395	530	660	795	925	1060	1190	1325	1455	1590
5.5	290	435	580	730	875	1020	1165	1310	1455	1600	1745
6.0	315	475	635	795	955	1110	1270	1430	1590	1745	1905
6.5	345	515	690	860	1030	1205	1375	1550	1720	1890	2065
7.0	370	555	740	925	1110	1295	1480	1665	1850	2035	2220
7.5	395	595	795	990	1190	1390	1585	1785	1985	2180	2380
8.0	425	635	845	1055	1270	1480	1690	1905	2115	2325	2540
8.5	450	675	900	1120	1345	1570	1795	2020	2245	2470	2695
9.0	475	715	950	1190	1425	1665	1900	2140	2375	2615	2855
9.5	500	750	1005	1255	1505	1755	2005	2255	2510	2760	3010
10.0	530	790	1055	1320	1585	1845	2110	2375	2640	2900	3165
10.5	555	830	1105	1385	1660	1940	2215	2490	2770	3045	3320
11.0	580	870	1160	1450	1740	2030	2320	2610	2900	3190	3480
11.5	605	910	1210	1515	1820	2120	2425	2725	3030	3335	3635
12.0	630	945	1260	1575	1890	2205	2520	2835	3150	3465	3780

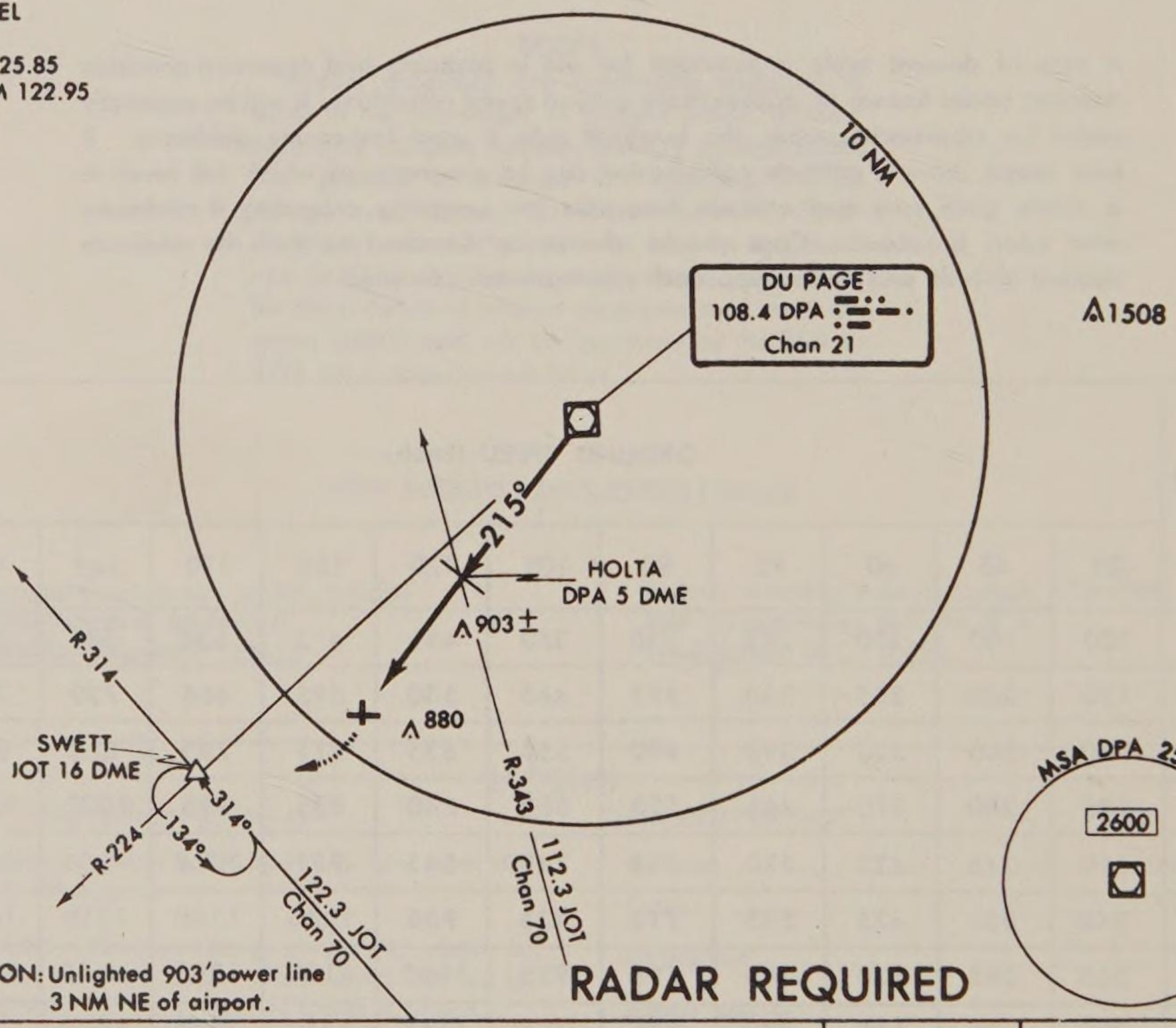
Not for use in Navigation

Amdt 10

VOR-A

AURORA MUNI(ARR)
AURORA, ILLINOIS

CHICAGO APP CON
133.5 371.9
AURORA TOWER★
120.6 (CTAF)
GND CON
121.7
CLNC DEL
121.7
ATIS★ 125.85
UNICOM 122.95

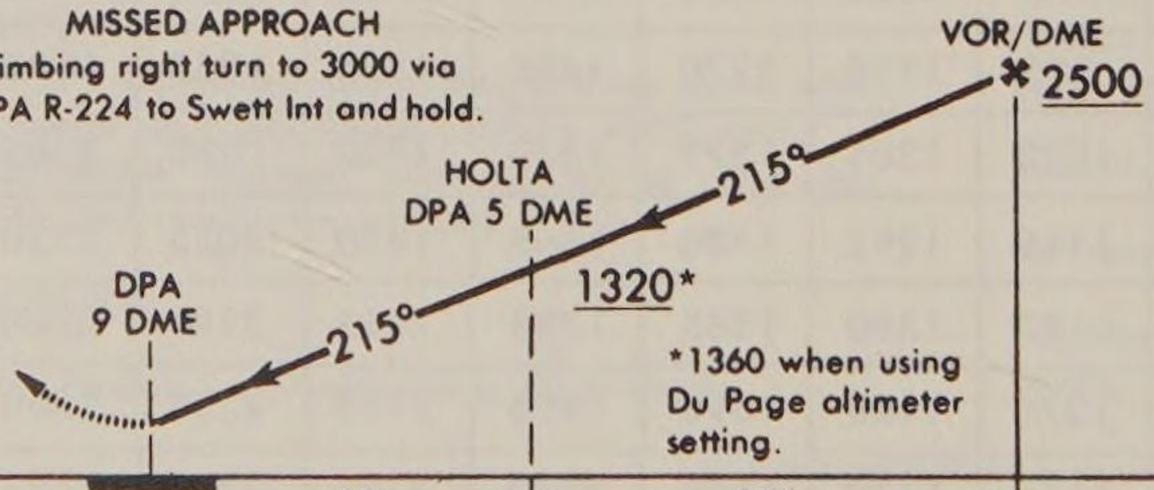


△1508

CAUTION: Unlighted 903'power line 3 NM NE of airport.

RADAR REQUIRED

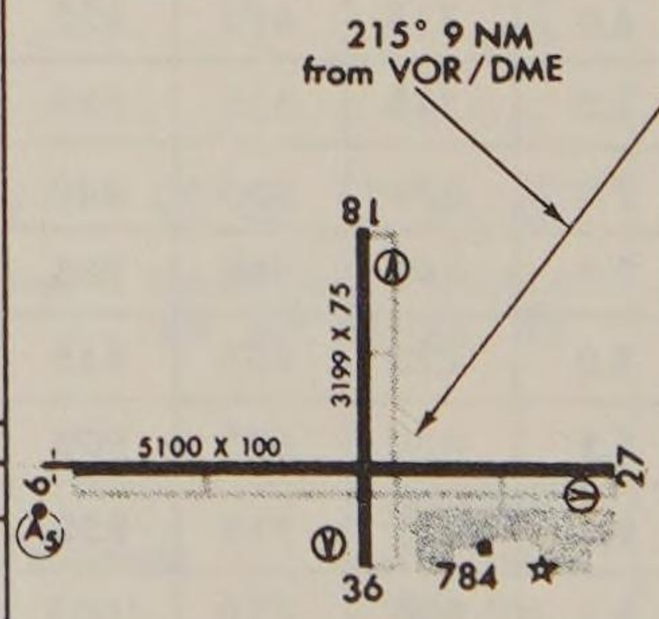
MISSED APPROACH
Climbing right turn to 3000 via DPA R-224 to Swett Int and hold.



CATEGORY	A	B	C	D
CIRCLING	1320-1 614 (700-1)		1320-1¾ 614 (700-1¾)	1320-2 614 (700-2)
HOLTA FIX MINIMUMS				
CIRCLING	1180-1 474 (500-1)		1180-1½ 474 (500-1½)	1260-2 554 (600-2)

When control zone not in effect, use Du Page altimeter setting and increase all MDAs 40 feet.
When control tower closed, activate MALSR Rwy 9, MIRL Rwys 9-27, 18-36 and REIL Rwys 18, 27, 36-CTAF.
△

ELEV 706



MIRL Rwys 9-27 and 18-36
REIL Rwys 18, 27 and 36

FAF to MAP 9 NM					
Knots	60	90	120	150	180
Min:Sec	9:00	6:00	4:30	3:36	3:00

VOR-A

41°46'N-88°28'W

AURORA, ILLINOIS
AURORA MUNI(ARR)

Not for use in Navigation

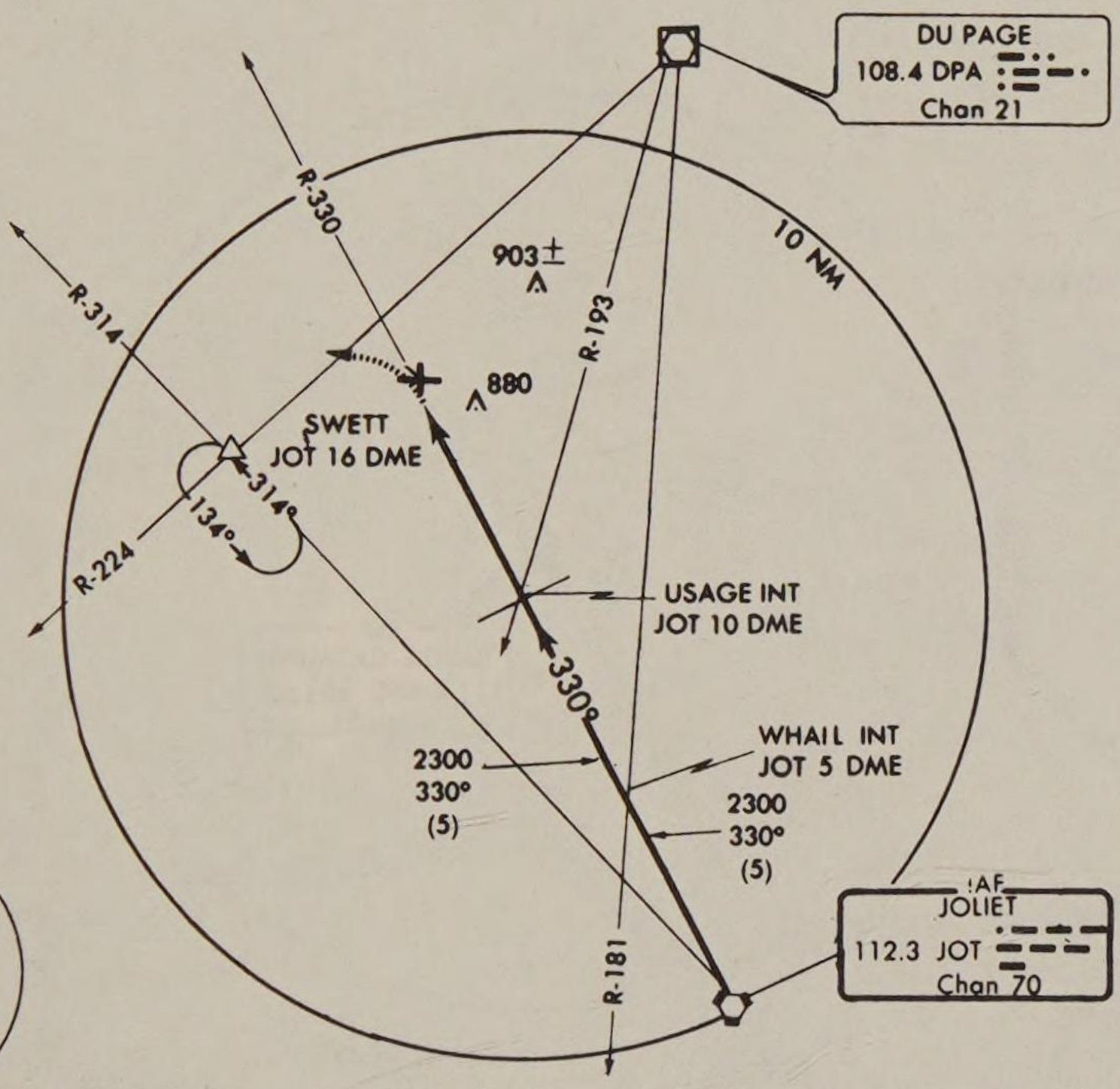
Amdt 6

VOR RWY 36

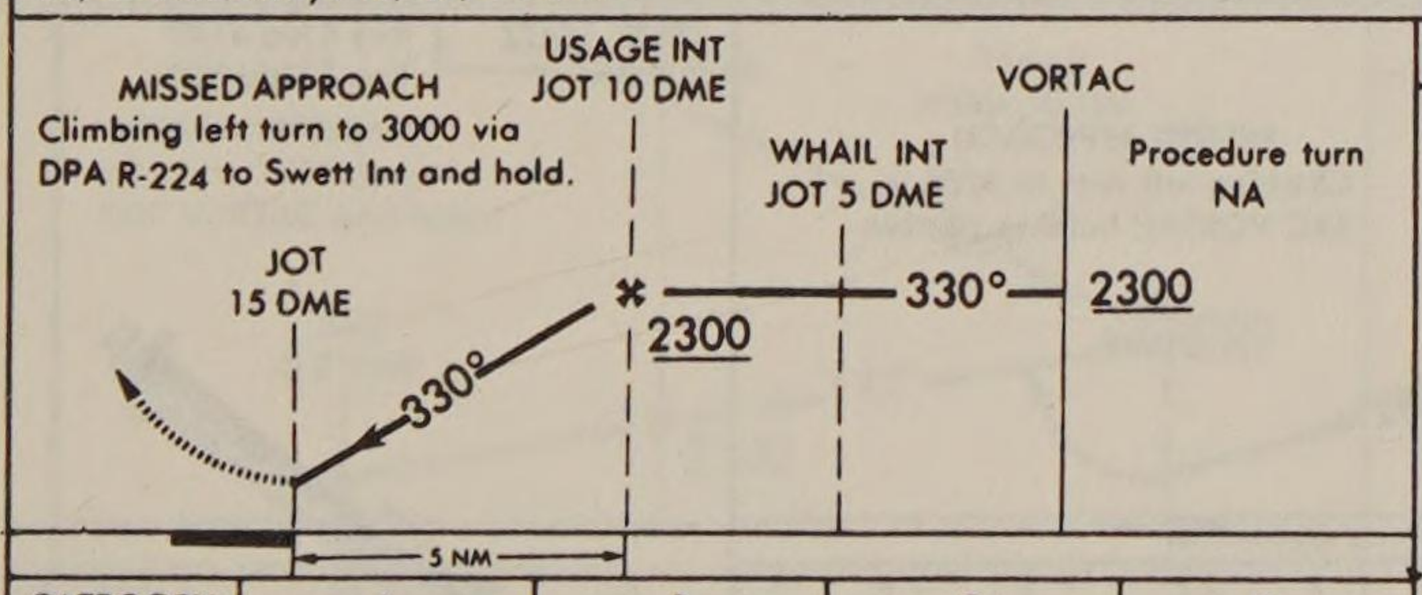
AURORA MUNI (ARR)
AURORA, ILLINOIS

CHICAGO APP CON
133.5 371.9
AURORA TOWER★
120.6 (CTAF)
GND CON
121.7
CLNC DEL
121.7
ATIS★ 125.85
UNICOM 122.95

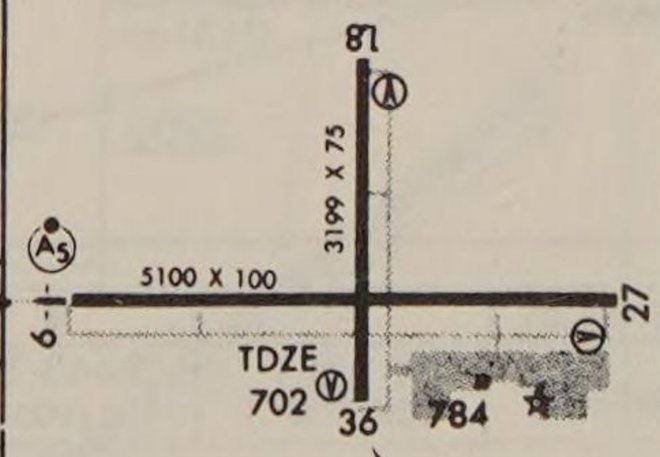
1508 ⚠



When control tower closed, activate MALSR Rwy 9, MIRL Rwys 9-27, 18-36, and REIL Rwys 18, 27, 36-CTAF



ELEV 706



CATEGORY	A	B	C	D
S-36	1140-1 438 (500-1)		1140-1¼ 438 (500-1¼)	1140-1½ 438 (500-1½)
CIRCLING	1180-1 474 (500-1)		1180-1½ 474 (500-1½)	1260-2 554 (600-2)
DUPAGE ALTIMETER SETTING MINIMUMS				
S-36	1180-1 478 (500-1)		1180-1¼ 478 (500-1¼)	1180-1½ 478 (500-1½)
CIRCLING	1220-1 514 (600-1)		1220-1½ 514 (600-1½)	1260-2 554 (600-2)

When control zone not in effect, use DuPage altimeter setting.
⚠

330° 5 NM from Usage Int JOT 10 DME

MIRL Rwys 9-27 and 18-36
REIL Rwys 18, 27 and 36

FAF to MAP 5 NM

Knots	60	90	120	150	180
Min:Sec	5:00	3:20	2:30	2:00	1:40

VOR RWY 36 41°46'N – 88°28'W AURORA, ILLINOIS
AURORA MUNI (ARR)

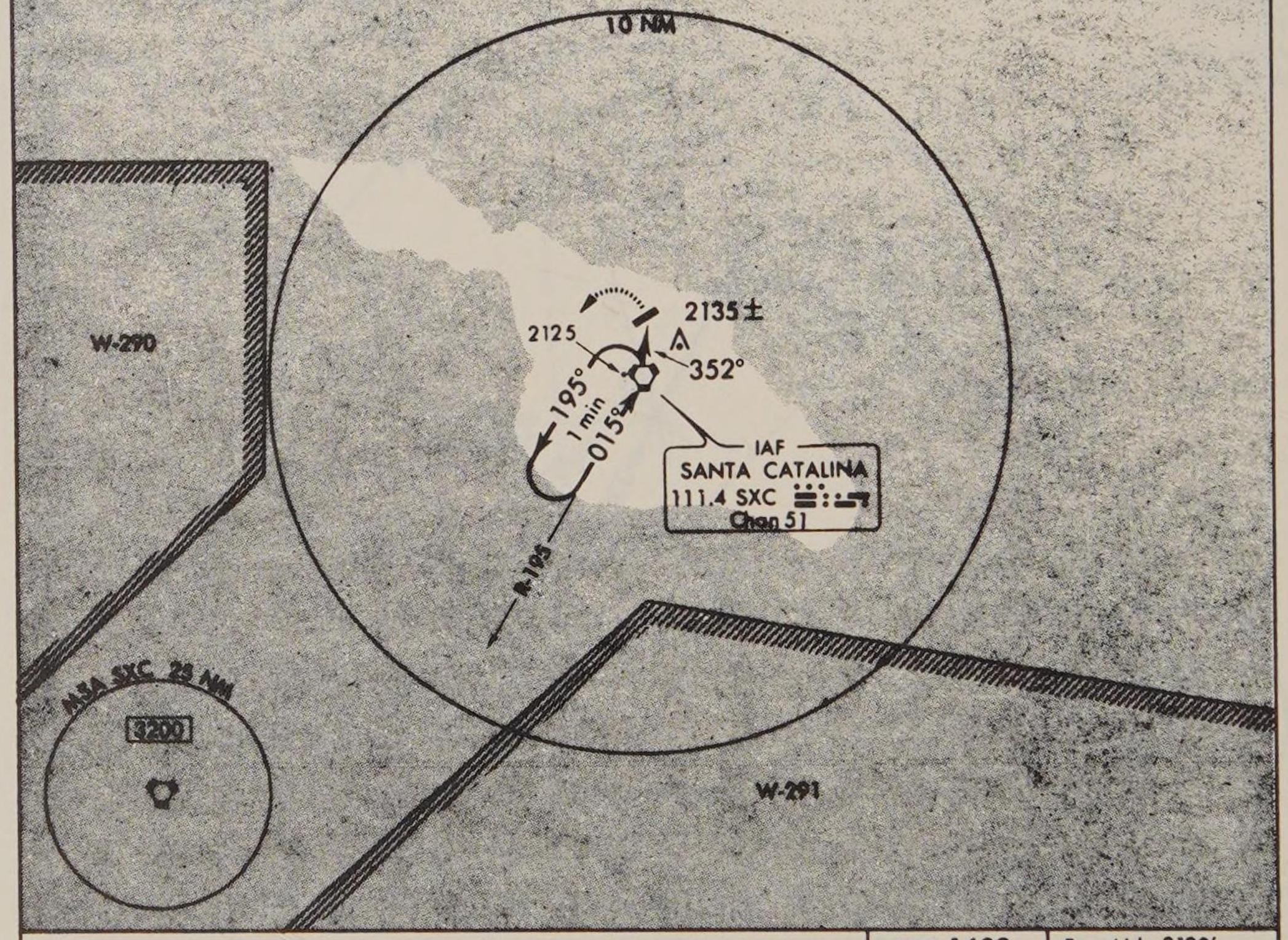
Not for use in Navigation

Amdt 4

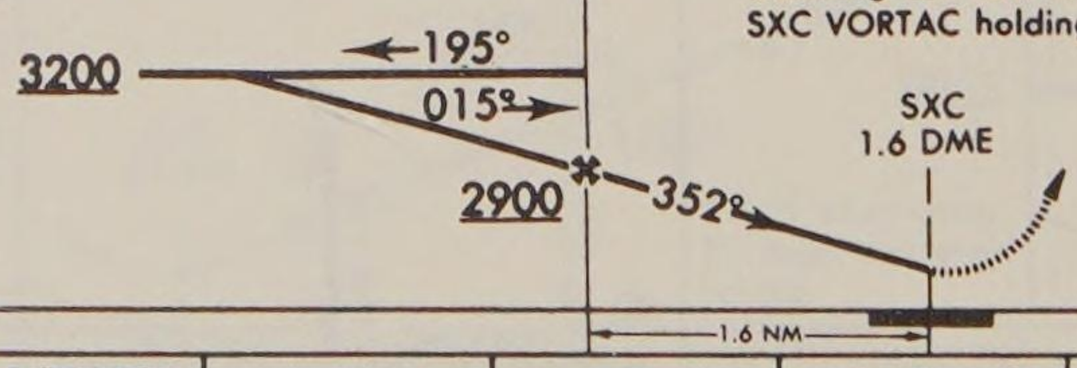
VOR-A

AVALON/CATALINA (AVX)
AVALON, CALIFORNIA

LOS ANGELES CENTER
127.4 354.1
UNICOM 122.7 (CTAF)



One Minute Holding Pattern



MISSED APPROACH
Climbing left turn to 3200 in SXC VORTAC holding pattern.

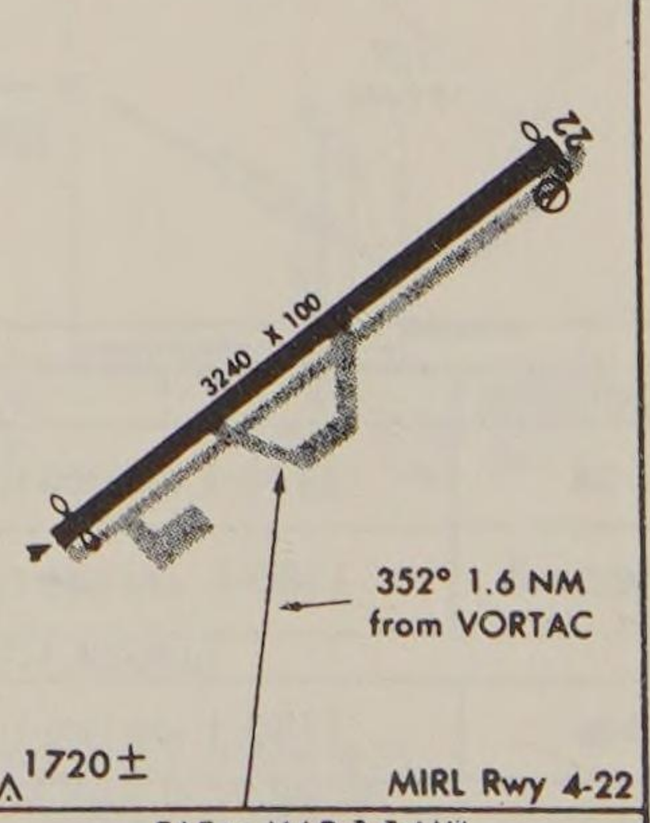
CATEGORY	A	B	C	D
CIRCLING	2440-1 838 (900-1)	2440-1¼ 838 (900-1¼)	NA	NA

Obtain local altimeter setting on UNICOM 122.7; when not available procedure not authorized.

T A NA

ELEV 1602

Rwy 4 ldg 3120'
Rwy 22 ldg 3091'



FAF to MAP 1.6 NM					
Knots	60	90	120	150	180
Min:Sec	1:36	1:04	0:48	0:38	0:32

VOR-A

33°24'N – 118°25'W

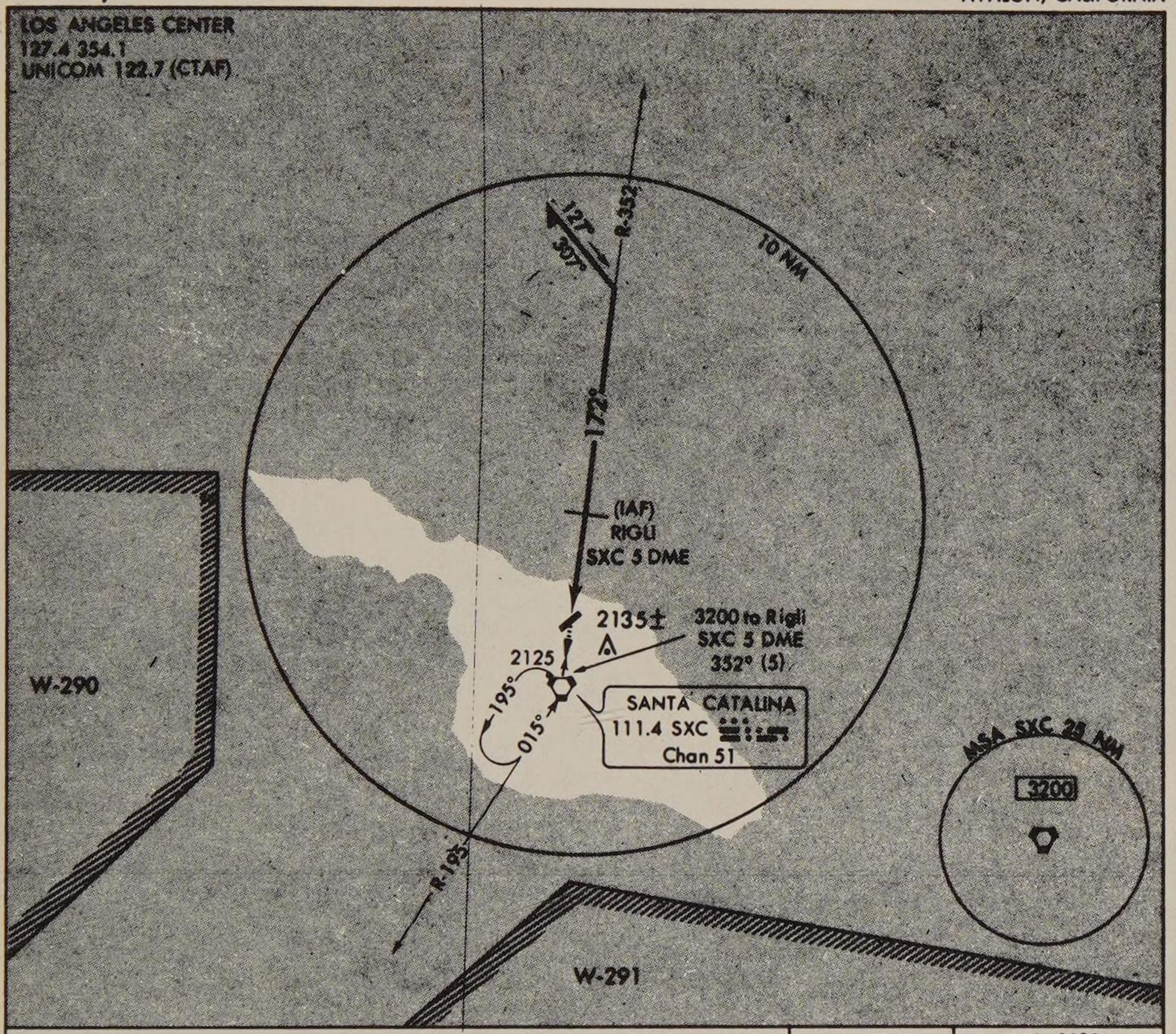
AVALON, CALIFORNIA
AVALON/CATALINA (AVX)

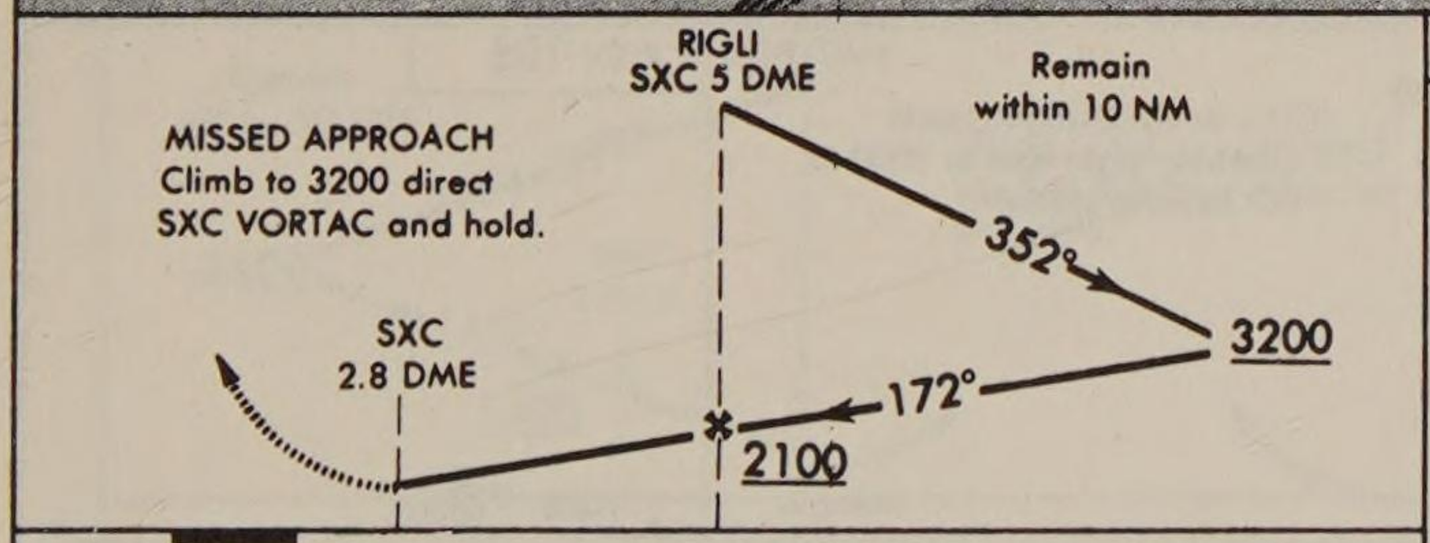
Not for use in Navigation

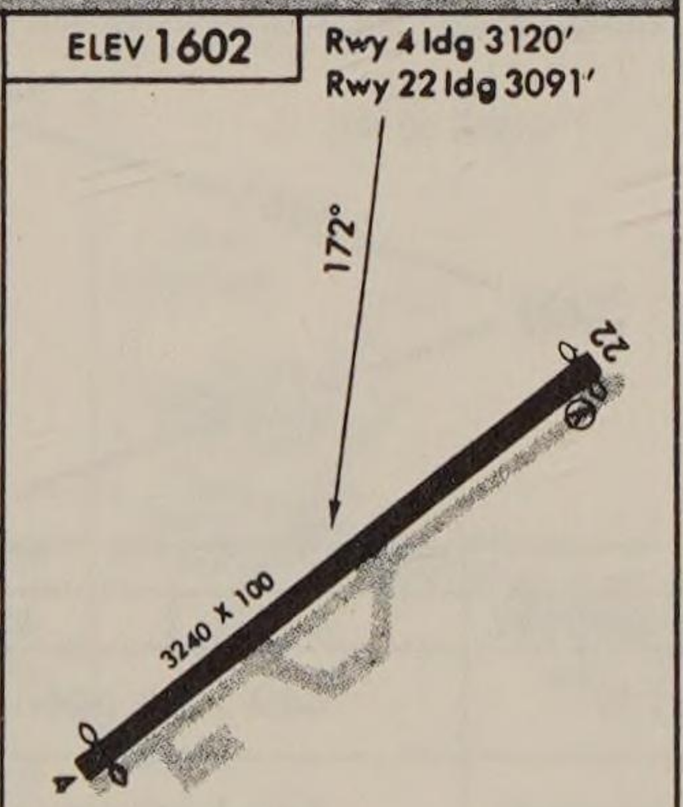
Amdt 2

VOR/DME-B

AVALON/CATALINA (AVX)
AVALON, CALIFORNIA







CATEGORY	A	B	C	D
CIRCLING	2100-1 498 (500-1)		NA	NA

Obtain local altimeter setting on UNICOM 122.7; when not available procedure not authorized.
Circling southeast runway 4-22 not authorized.

NA

Knots	60	90	120	150	180
Min:Sec					

VOR/DME-B

33°24'N-118°25'W

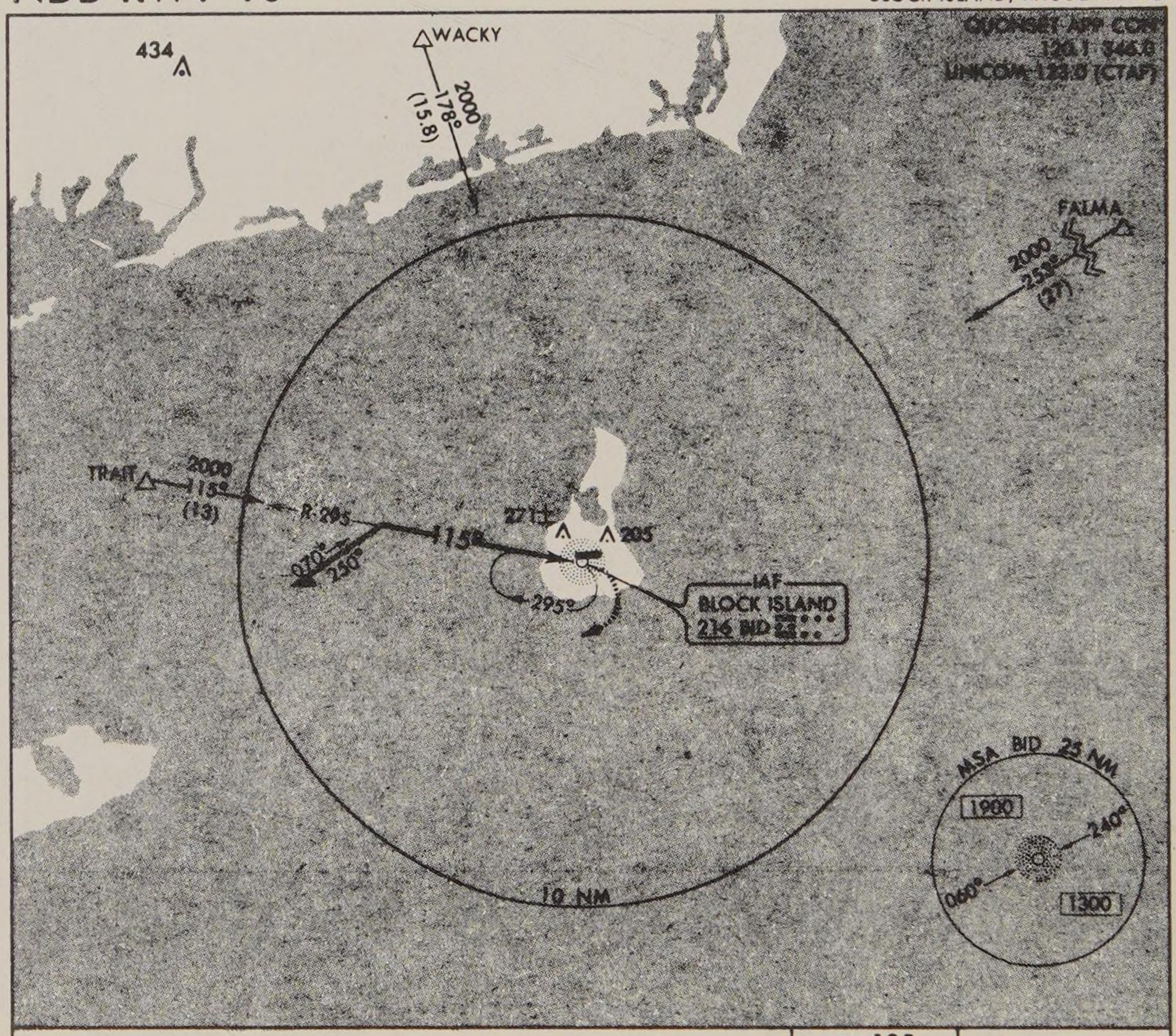
AVALON, CALIFORNIA
AVALON/CATALINA (AVX)

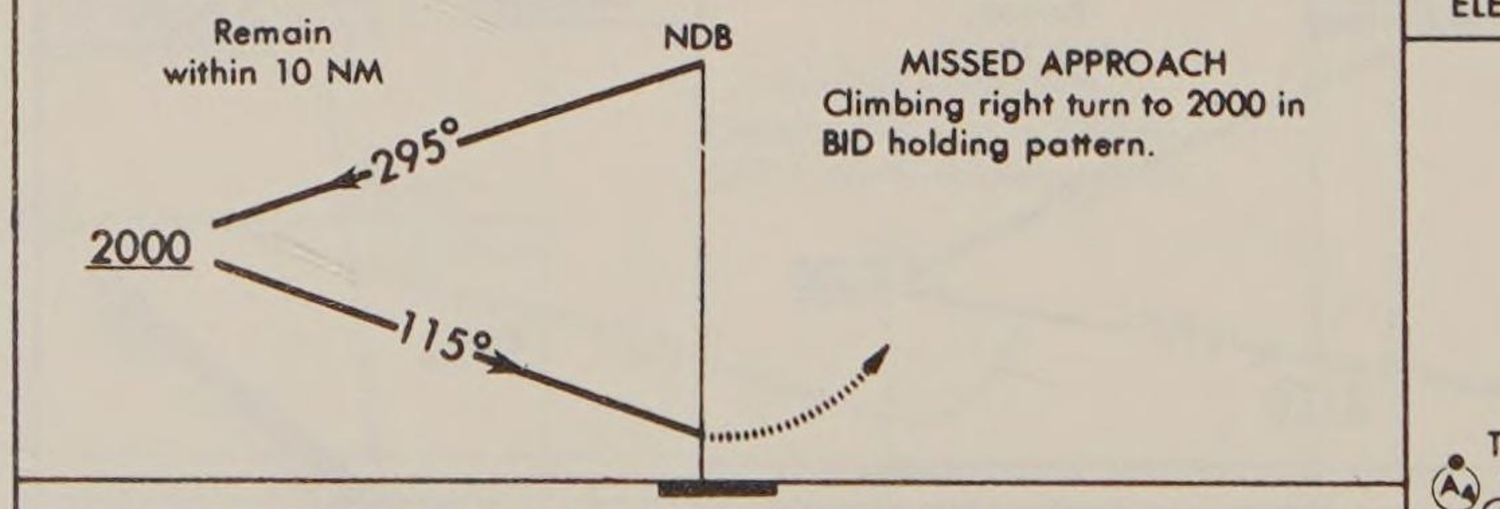
Not for use in Navigation

Orig

NDB RWY 10

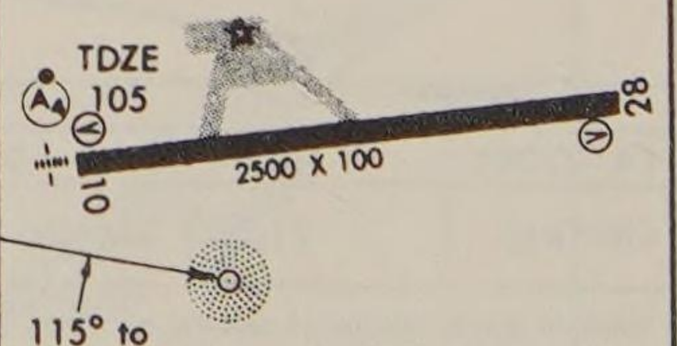
BLOCK ISLAND STATE (BID)
BLOCK ISLAND, RHODE ISLAND





MISSED APPROACH
Climbing right turn to 2000 in BID holding pattern.

ELEV 105



REIL Rwy 28
MIRL Rwy 10-28

CATEGORY	A	B	C	D
S-10	640-1 535 (600-1)		640-1½ 535 (600-1½)	NA
CIRCLING	640-1 535 (600-1)		640-1½ 535 (600-1½)	NA

Obtain local altimeter setting on UNICOM; when not available, use Providence altimeter setting and increase all MDAs 160 feet.
Inoperative table does not apply.
For MALSF Rwy 10, REIL Rwy 28, MIRL Rwy 10-28, and VASI Rwys 10 and 28-CTAF.
▽
△NA

Knots	60	90	120	150	180
Min:Sec					

NDB RWY 10

41°10'N–71°35'W

BLOCK ISLAND, RHODE ISLAND
BLOCK ISLAND STATE (BID)

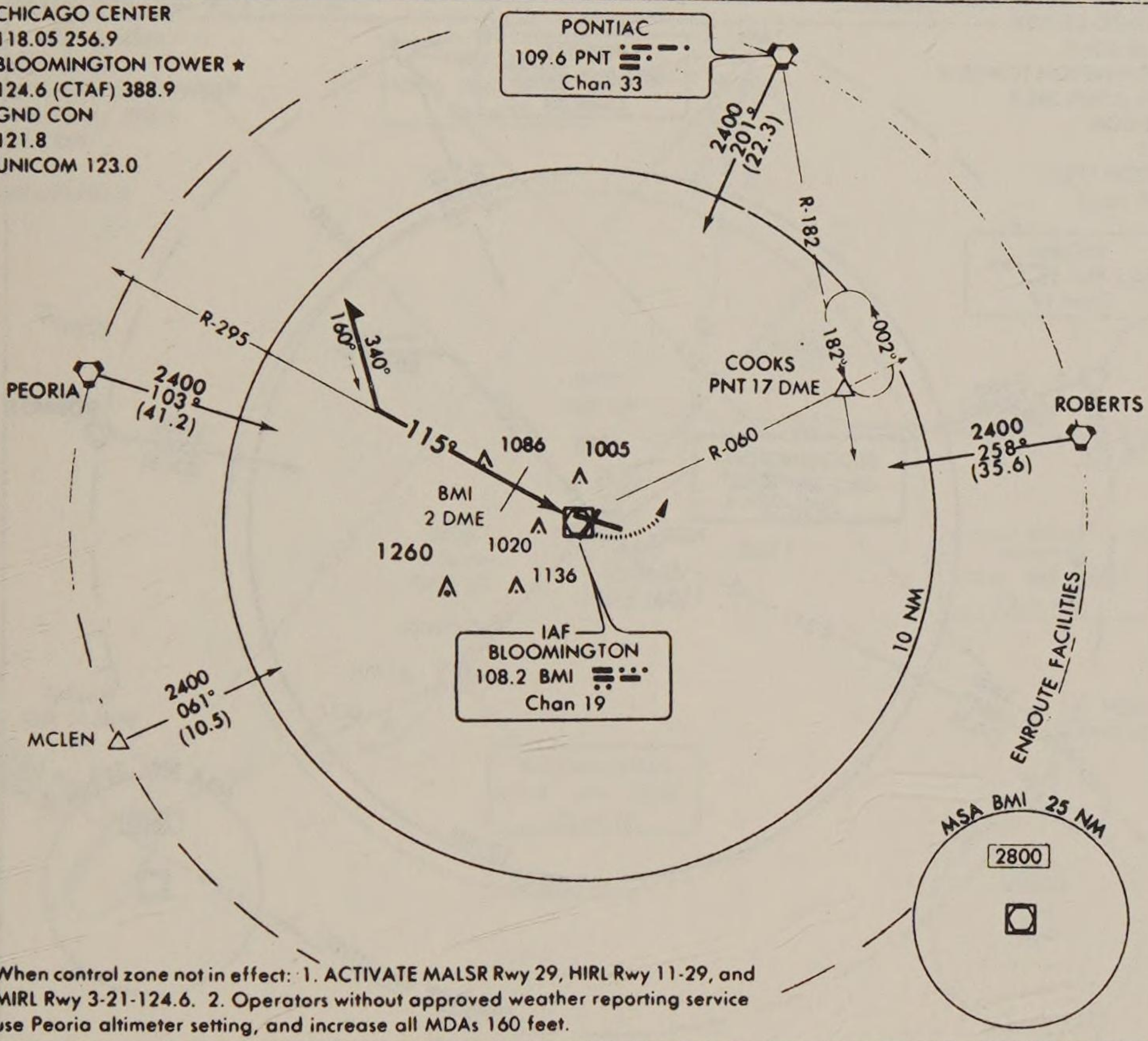
Not for use in Navigation

Amdt 8

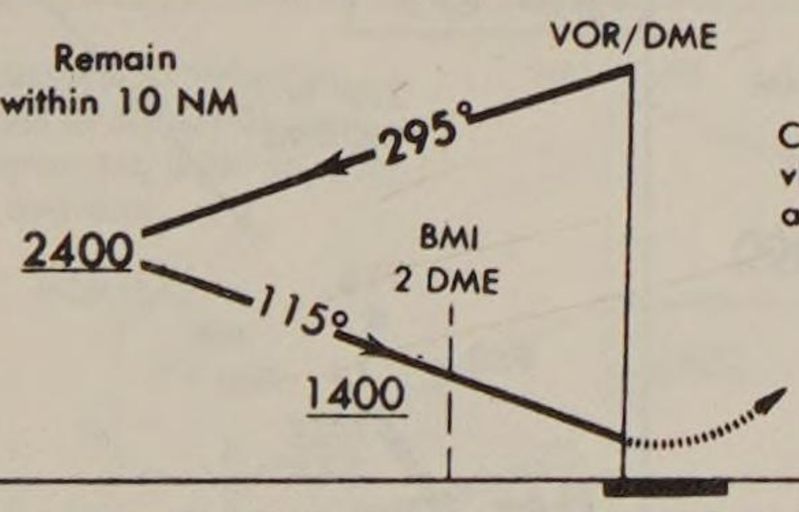
VOR RWY 11

BLOOMINGTON-NORMAL (BMI)
BLOOMINGTON - NORMAL, ILLINOIS

CHICAGO CENTER
118.05 256.9
BLOOMINGTON TOWER ★
124.6 (CTAF) 388.9
GND CON
121.8
UNICOM 123.0

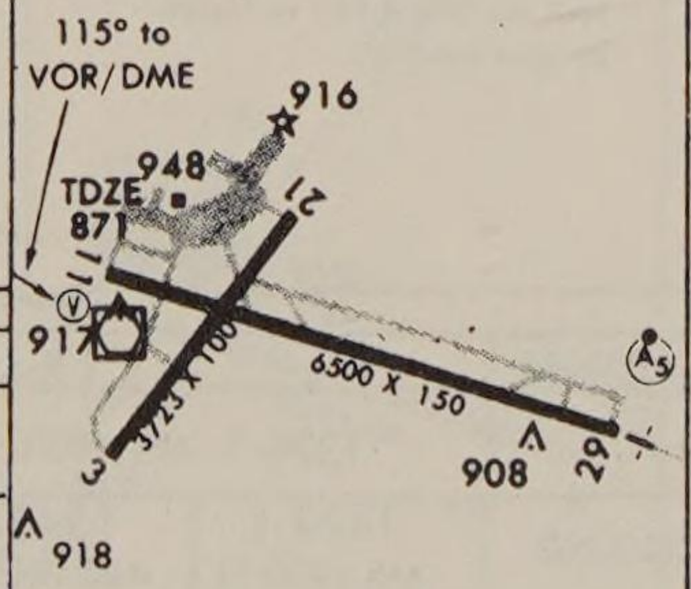


When control zone not in effect: 1. ACTIVATE MALSR Rwy 29, HIRL Rwy 11-29, and MIRL Rwy 3-21-124.6. 2. Operators without approved weather reporting service use Peoria altimeter setting, and increase all MDAs 160 feet.



MISSED APPROACH
Climbing left turn to 3000 via BMI R-060 to Cooks Int and hold.

ELEV 875



CATEGORY	A	B	C	D
S-11	1400-1 529 (600-1)		1400-1½ 529 (600-1½)	1400-1¾ 529 (600-1¾)
CIRCLING	1400-1 525 (600-1)		1400-1½ 525 (600-1½)	1440-2 565 (600-2)
DME MINIMA				
S-11	1280-1 409 (500-1)		1280-1¼ 409 (500-1¼)	
CIRCLING	1320-1 445 (500-1)	1340-1 465 (500-1)	1340-1½ 465 (500-1½)	1440-2 565 (600-2)

MIRL Rwy 3-21
REIL Rwys 11 and 21
HIRL Rwy 11-29

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 11

40°29'N-88°55'W

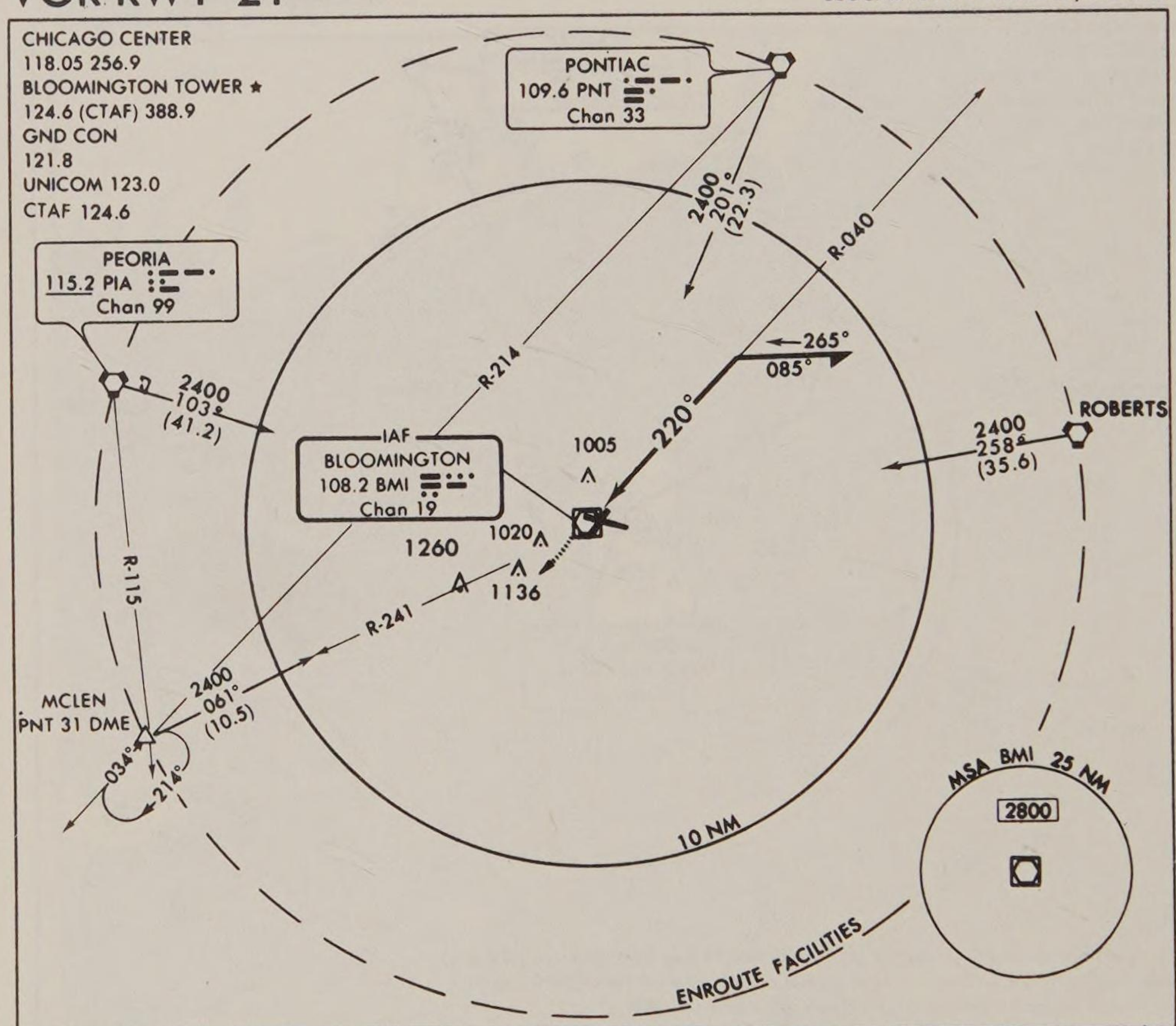
BLOOMINGTON - NORMAL, ILLINOIS
BLOOMINGTON-NORMAL (BMI)

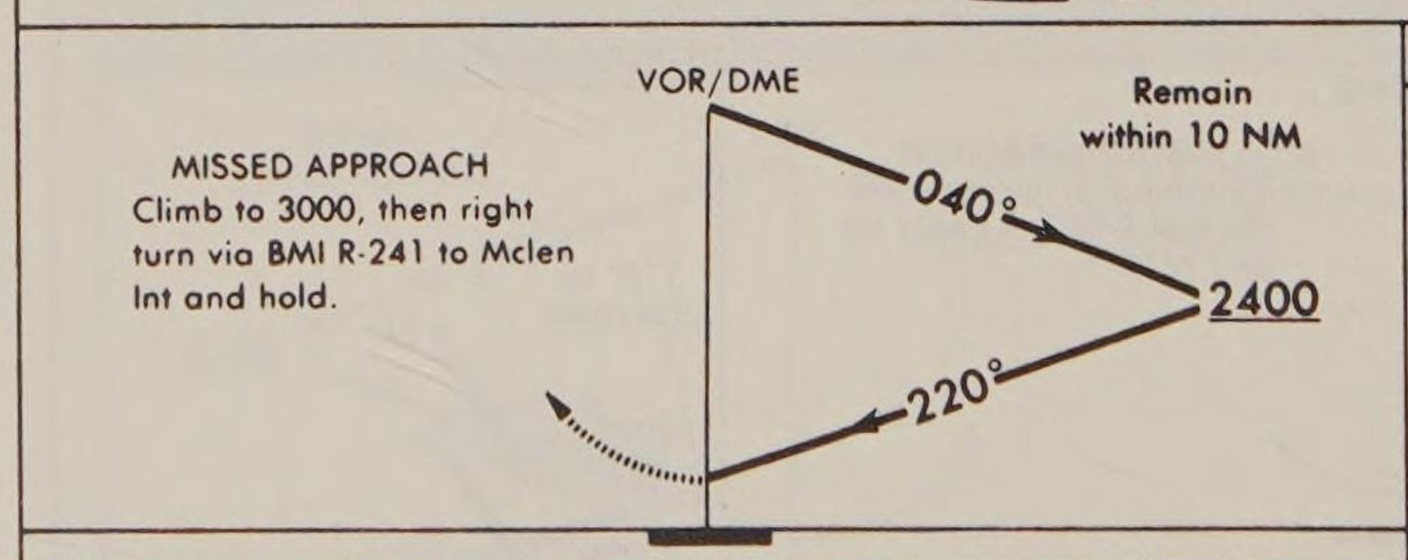
Not for use in Navigation

Amdt 15

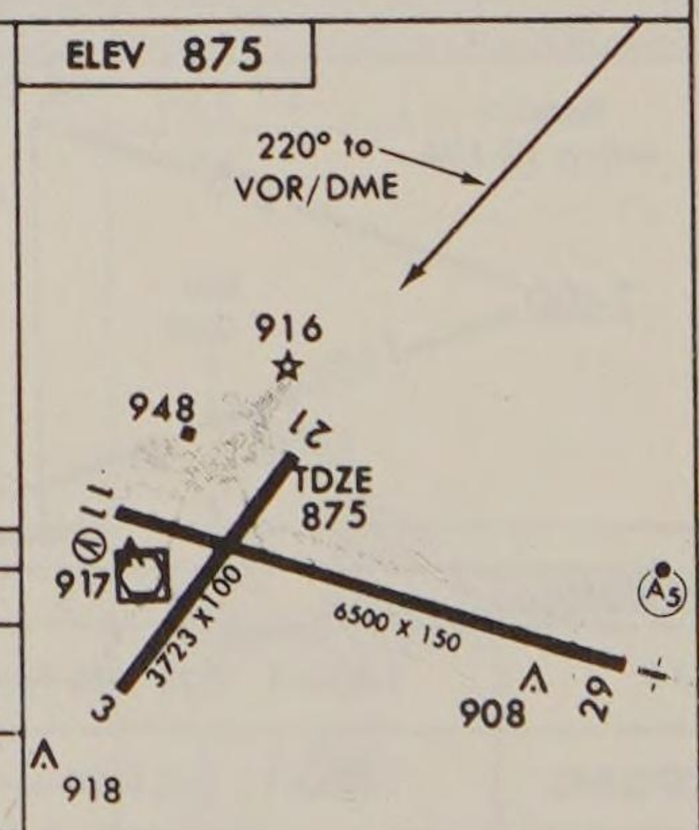
VOR RWY 21

BLOOMINGTON-NORMAL (BMI)
BLOOMINGTON-NORMAL, ILLINOIS





MISSED APPROACH
Climb to 3000, then right turn via BMI R-241 to Mclen Int and hold.



CATEGORY	A	B	C	D
S-21	1320-1 445 (500-1)		1320-1¼ 445 (500-1¼)	1320-1½ 445 (500-1½)
CIRCLING	1320-1 445 (500-1)	1340-1 465 (500-1)	1340-1½ 465 (500-1½)	1440-2 565 (600-2)

When control zone not in effect: 1. ACTIVATE MALSR Rwy 29, HIRL Rwy 11-29, and MIRL Rwy 3-21-124.6. 2. Operators without approved weather reporting service, use Peoria altimeter setting and increase all MDAs 160 feet.
△

MIRL Rwy 3-21
REIL Rwy 11 and 21
HIRL Rwy 11-29

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 21

40°29'N-88°55'W

BLOOMINGTON-NORMAL, ILLINOIS
BLOOMINGTON-NORMAL (BMI)

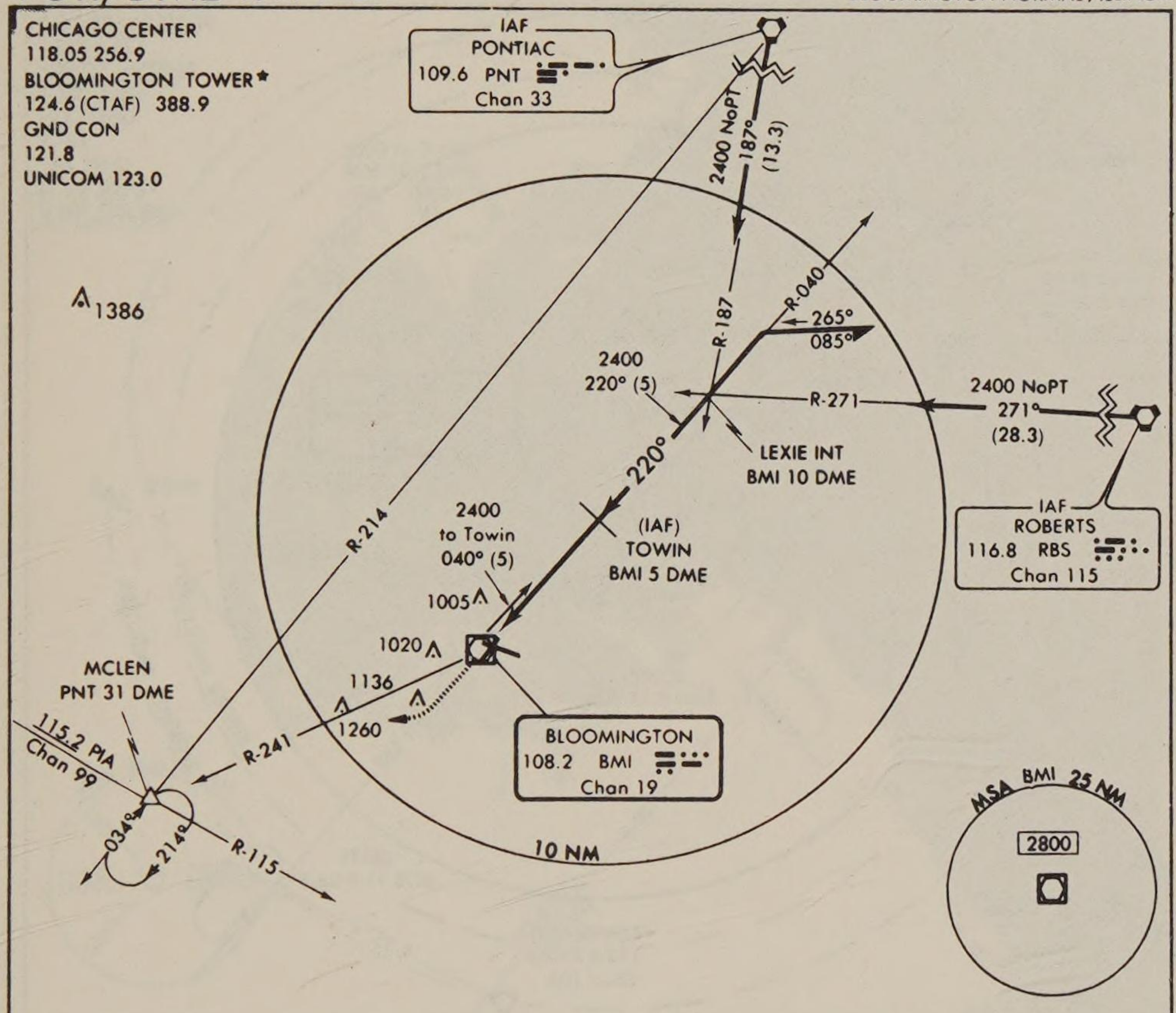
Not for use in Navigation

Orig

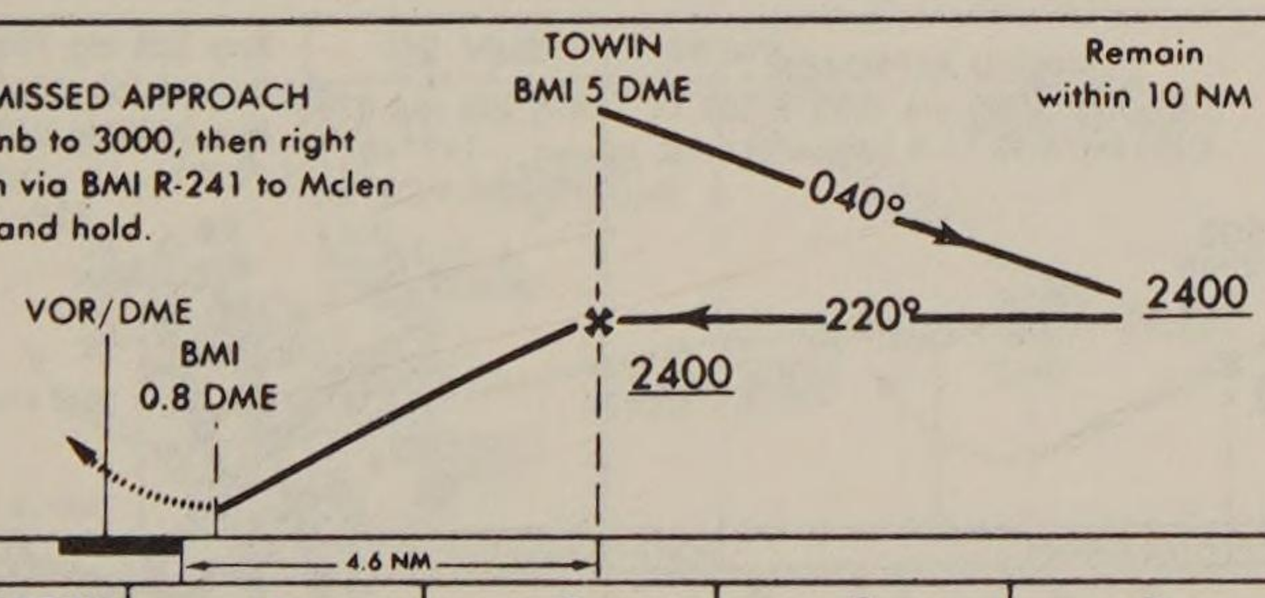
VOR/DME RWY 21

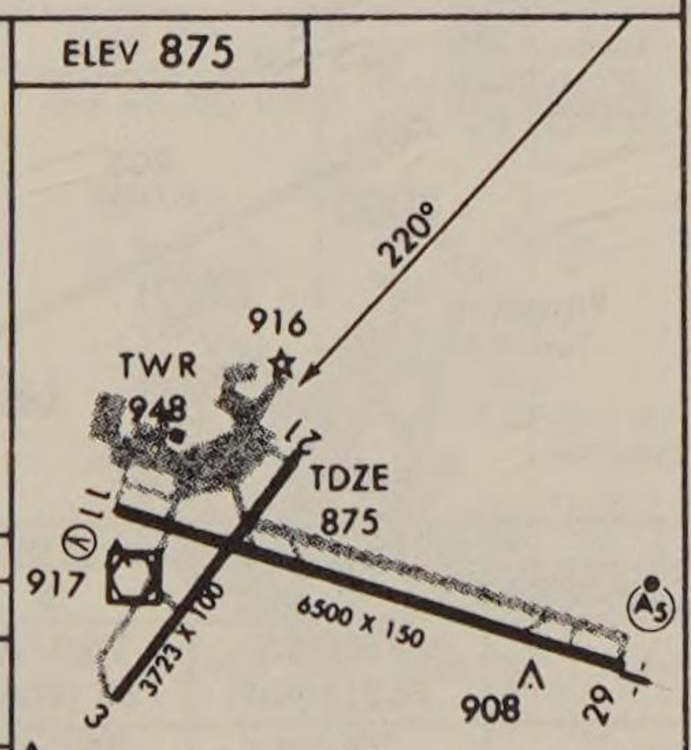
BLOOMINGTON-NORMAL (BMI)
BLOOMINGTON-NORMAL, ILLINOIS

CHICAGO CENTER
118.05 256.9
BLOOMINGTON TOWER*
124.6 (CTAF) 388.9
GND CON
121.8
UNICOM 123.0



MISSED APPROACH
Climb to 3000, then right turn via BMI R-241 to Mclen Int and hold.





CATEGORY	A	B	C	D
S-21	1260-1 385 (400-1)			1260-1¼ 385 (400-1¼)
CIRCLING	1320-1 445 (500-1)	1340-1 465 (500-1)	1340-1½ 465 (500-1½)	1440-2 565 (600-2)

When control zone not in effect: 1. ACTIVATE MALSR Rwy 29, HIRL Rwy 11-29, and MIRL Rwy 3-21-124.6. 2. Operators without approved weather reporting service, use Peoria altimeter setting and increase all MDAs 160 feet.
A

REIL Rwys 11 and 21
MIRL Rwy 3-21
HIRL Rwy 11-29

Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 21 40°29'N-88°55'W

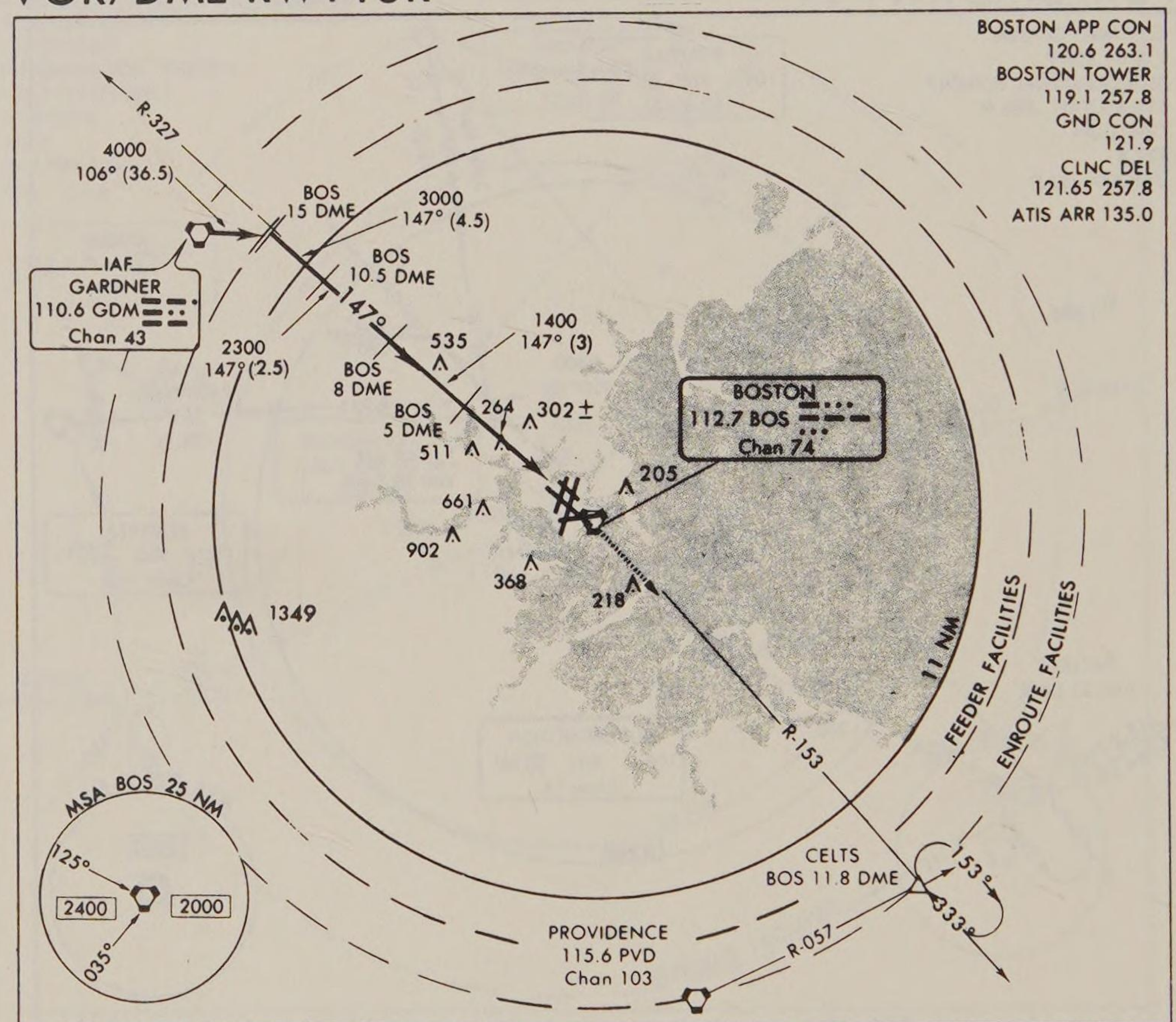
BLOOMINGTON-NORMAL, ILLINOIS
BLOOMINGTON-NORMAL (BMI)

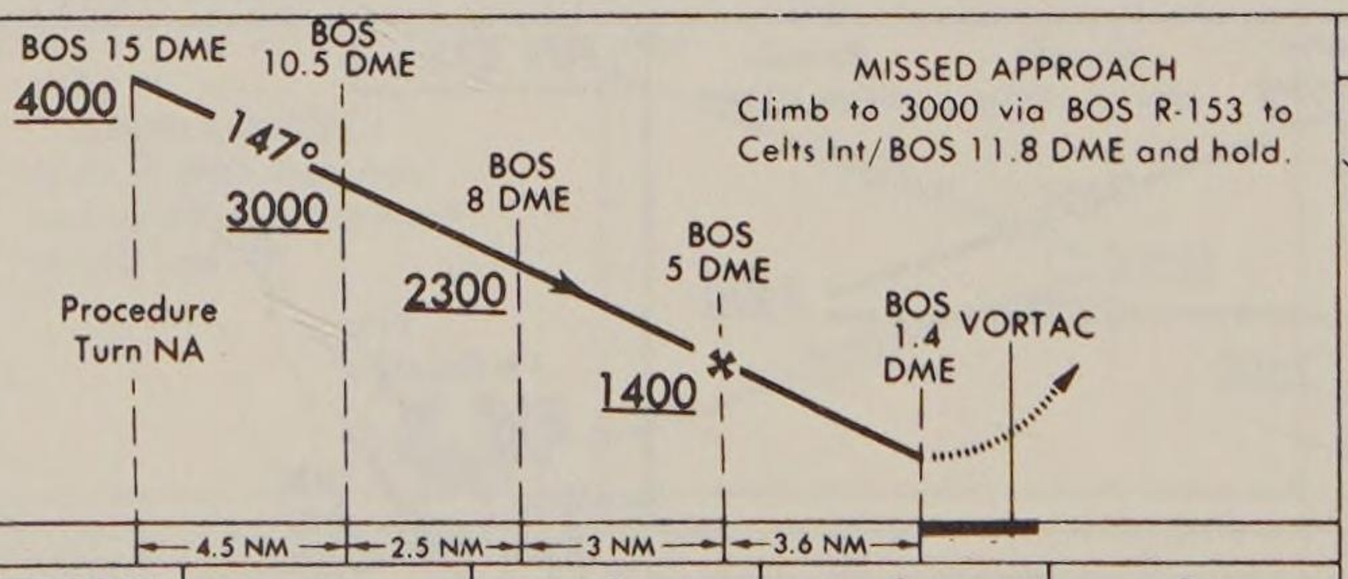
Not for use in Navigation

Amdt 15

VOR/DME RWY15R

BOSTON/GENERAL EDWARD LAWRENCE LOGAN INTL (BOS)
BOSTON, MASSACHUSETTS

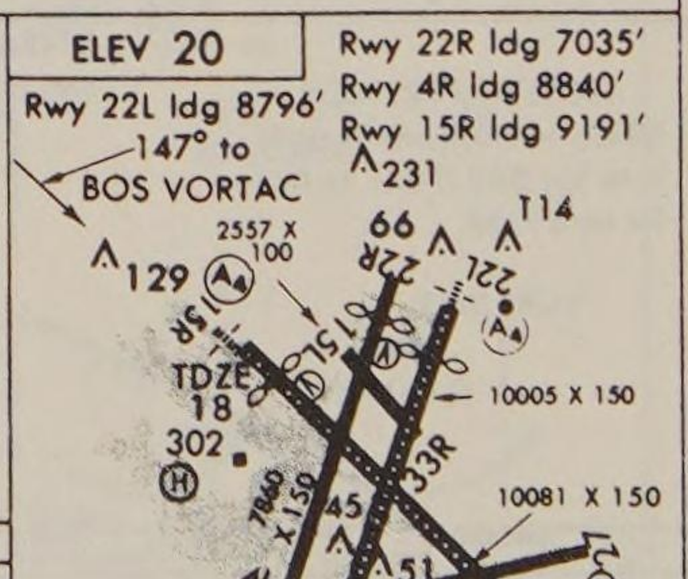




CATEGORY	A	B	C	D
S-15R	780/50 762 (800-1)	780/60 762 (800-1¼)	780-2¼ 762 (800-2¼)	780-2½ 762 (800-2½)
CIRCLING	780-1 760 (800-1)	780-1¼ 760 (800-1¼)	820-2¼ 800 (800-2¼)	820-2½ 800 (800-2½)

Cat. D circling not authorized Rwy 4L clockwise to Rwy 15R.
Inoperative table does not apply.

▽
△



Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 15R

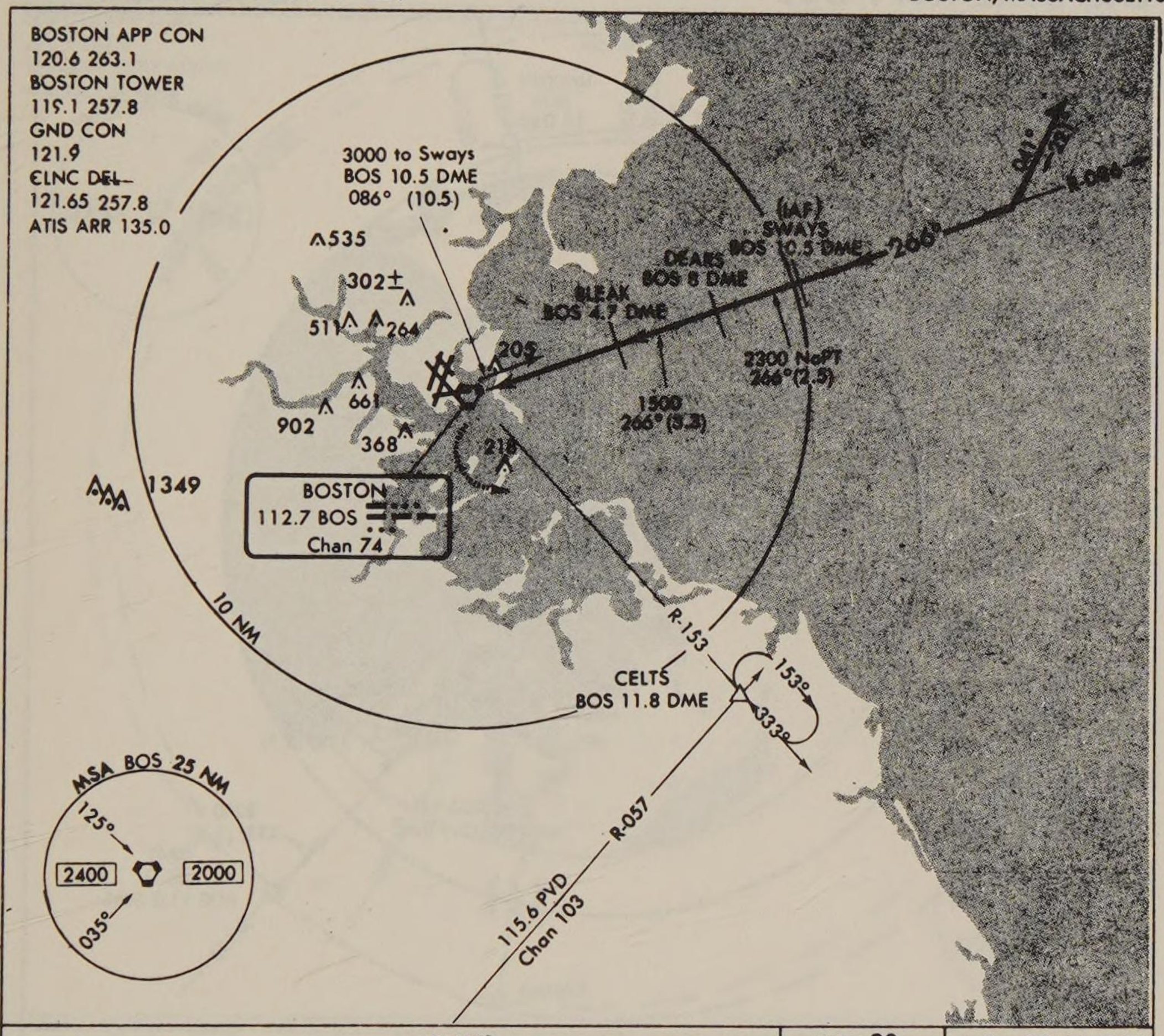
42°22'N-71°00'W
BOSTON/GENERAL EDWARD LAWRENCE LOGAN INTL (BOS)
BOSTON, MASSACHUSETTS

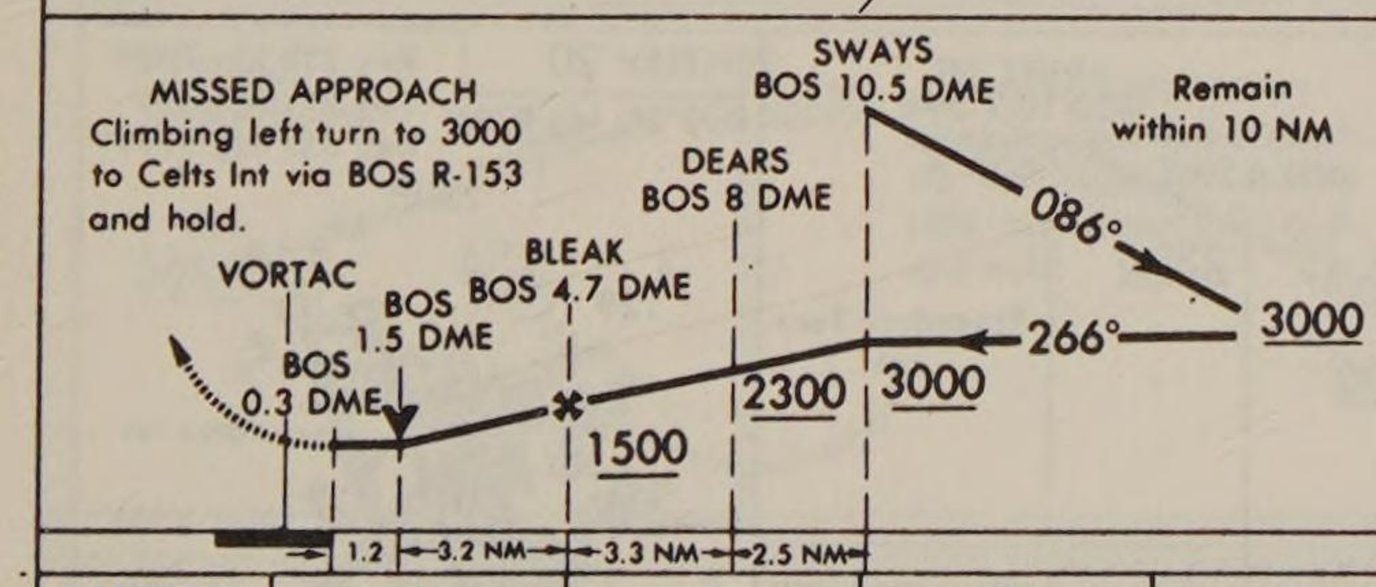
Not for use in Navigation

Amdt 1

VOR/DME RWY 27

BOSTON/GENERAL EDWARD LAWRENCE LOGAN INTL (BOS)
BOSTON, MASSACHUSETTS



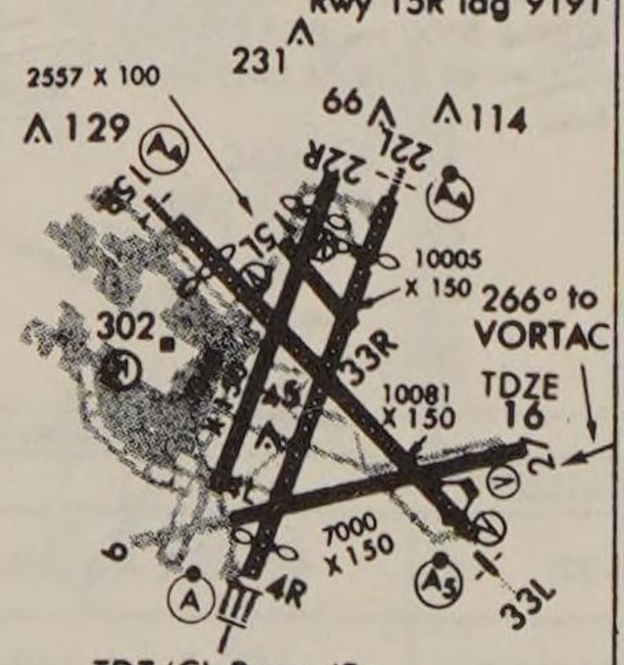


CATEGORY	A	B	C	D
S-27	460/50 444 (500-1)			
CIRCLING†	680-1 660 (700-1)		820-1½ 800 (800-1½)	820-2 800 (800-2)

† Cat. D circling not authorized in sector west of Rwy 4L clockwise to Rwy 15R.

ELEV 20

Rwy 22L ldg 8796'
Rwy 22R ldg 7035'
Rwy 4R ldg 8840'
Rwy 15R ldg 9191'



TDZ/CL Rwys 4R, 15R and 33L
368 REIL Rwys 4L and 27
HIRL Rwys 4L-22R, 4R-22L
15R-33L and 9-27
MIRL Rwy 15L-33R

Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 27

42°22'N-71°00'W

BOSTON, MASSACHUSETTS
BOSTON/GENERAL EDWARD LAWRENCE LOGAN INTL (BOS)

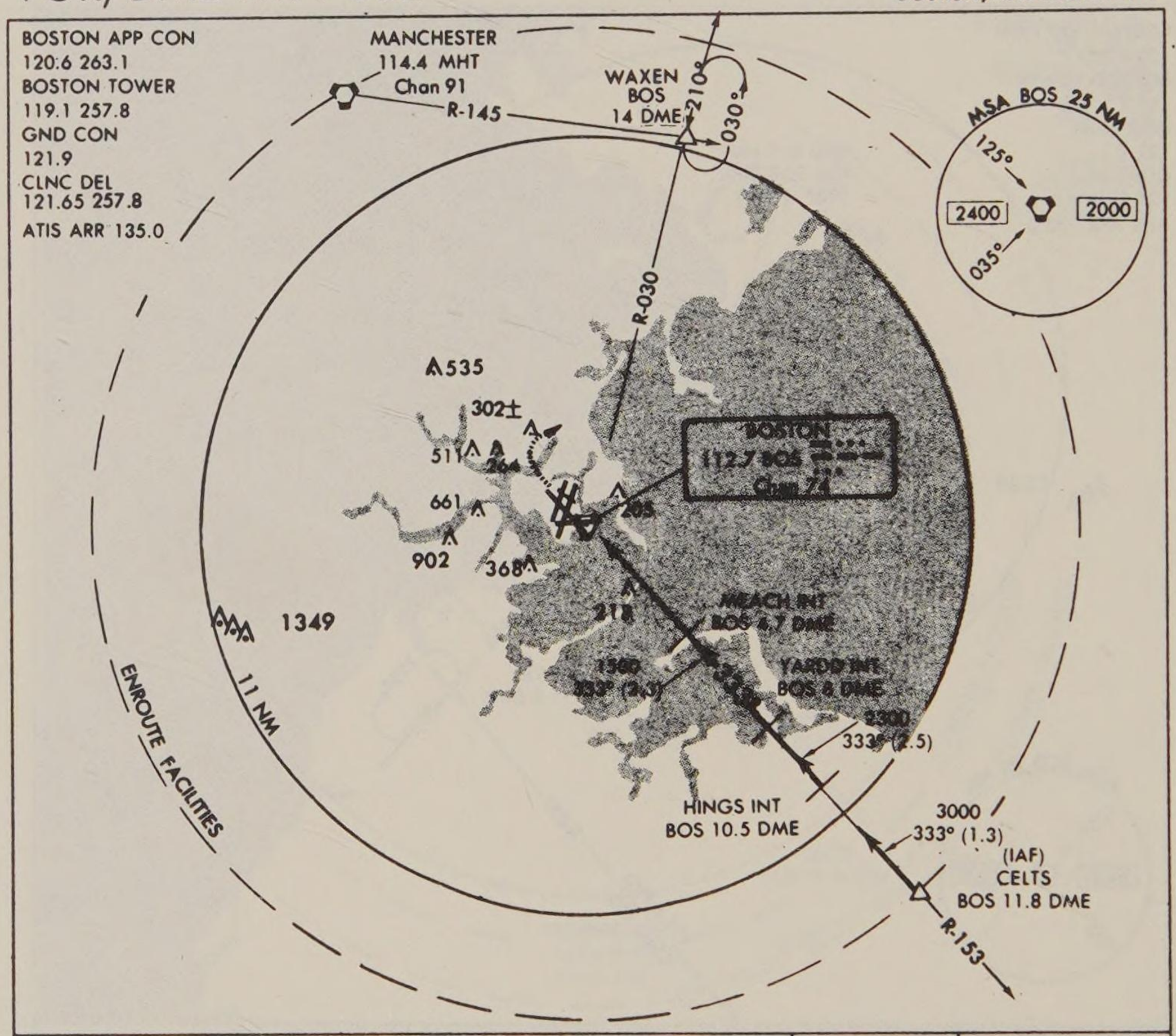
Not for use in Navigation

Amdt 18

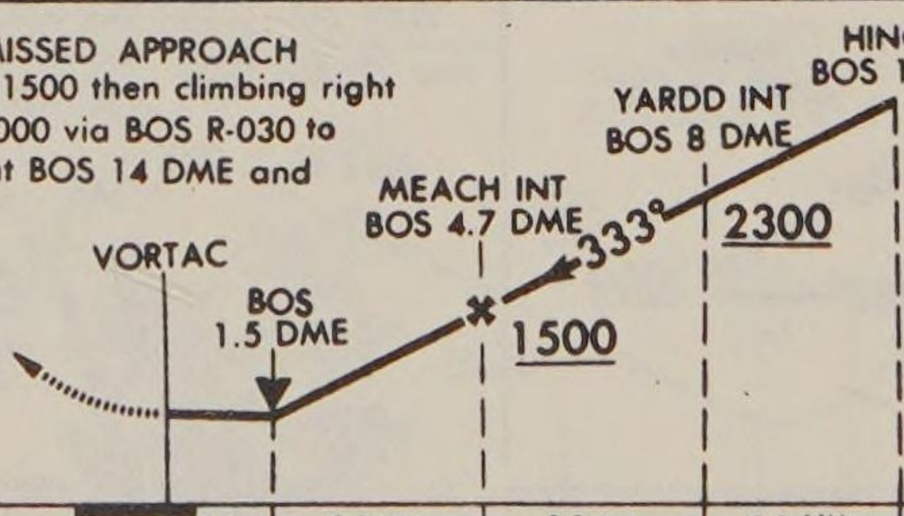
VOR/DME RWY 33L BOSTON/GENERAL EDWARD LAWRENCE LOGAN INTL (BOS)

BOSTON, MASSACHUSETTS

BOSTON APP CON
120.6 263.1
BOSTON TOWER
119.1 257.8
GND CON
121.9
CLNC DEL
121.65 257.8
ATIS ARR 135.0



MISSED APPROACH
Climb to 1500 then climbing right turn to 5000 via BOS R-030 to Waxen Int BOS 14 DME and hold.



Procedure Turn
NA

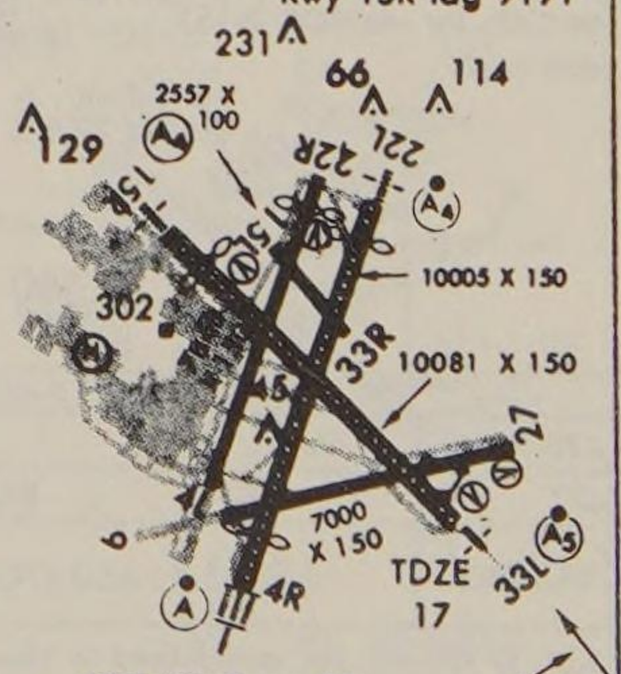
CATEGORY	A	B	C	D
S-33L	480/24 463 (500-½)		480/40 463 (500-¾)	480/50 463 (500-1)
CIRCLING	680-1 660 (700-1)		820-2¼ 800 (800-2¼)	820-2½ 800 (800-2½)

Category D circling not authorized Rwy 4L clockwise to Rwy 15R.

ELEV 20

Rwy 22L ldg 8796'

Rwy 22R ldg 7035'
Rwy 4R ldg 8840'
Rwy 15R ldg 9191'



TDZ/CL Rwys 4R 15R and 33L
MIRL Rwy 15L-33R
REIL Rwys 4L and 27
HIRL Rwys 4L-22R, 4R-22L, 15R-33L and 9-27

Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 33L 42°22'N-71°00'W BOSTON, MASSACHUSETTS

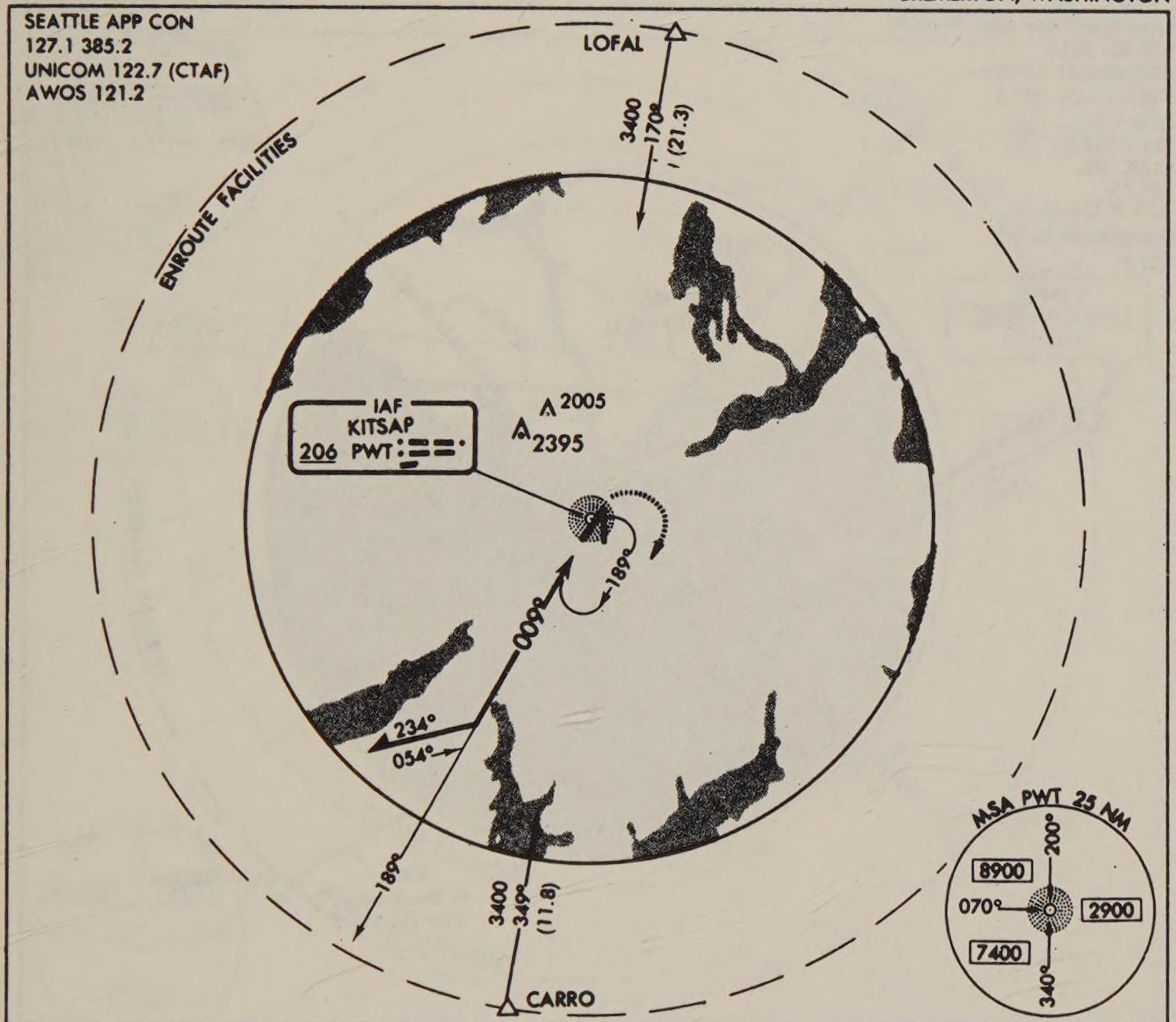
BOSTON/GENERAL EDWARD LAWRENCE LOGAN INTL (BOS)

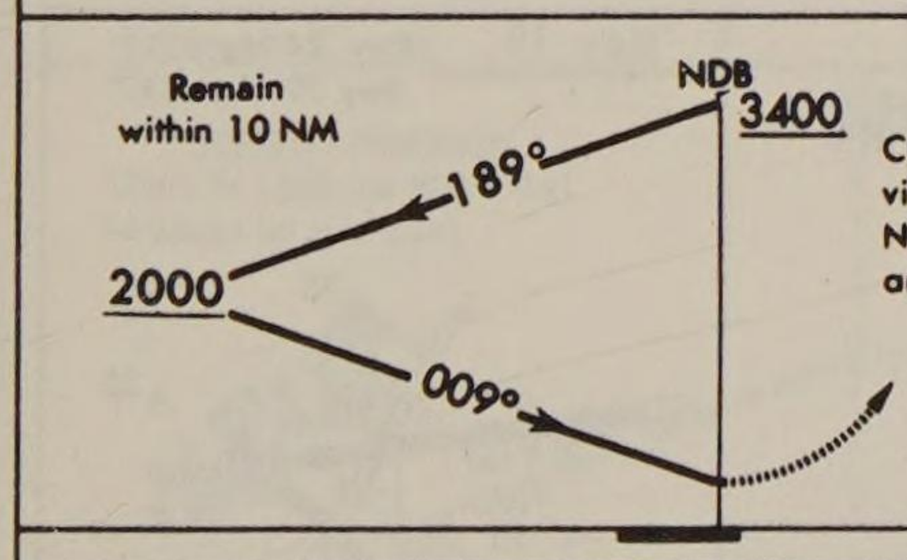
Not for use in Navigation

Amdt 13

NDB RWY 1

BREMERTON NATIONAL (PWT)
BREMERTON, WASHINGTON

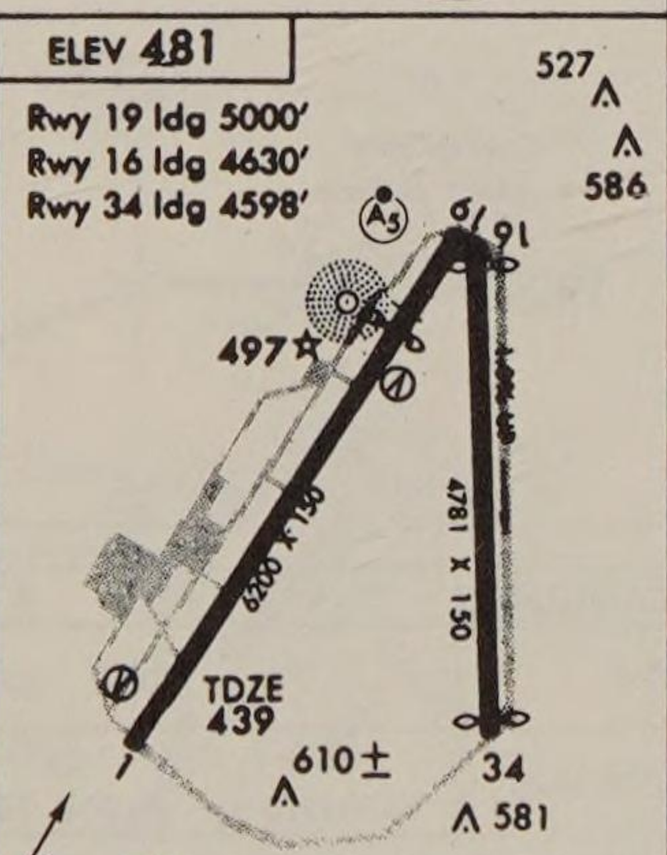




MISSED APPROACH
Climbing right turn to 3400 via 189° bearing from PWT NDB, then direct PWT NDB and hold.

ELEV 481

Rwy 19 ldg 5000'
Rwy 16 ldg 4630'
Rwy 34 ldg 4598'



MIRL Rwy 1-19
REIL Rwy 1

CATEGORY	A	B	C	D
S-1	980-1	541 (500-1)	980-1½ 541 (500-1½)	980-1¾ 541 (500-1¾)
CIRCLING	980-1	499 (500-1)	980-1½ 499 (500-1½)	1040-2 559 (600-2)

When control zone not in effect: 1. Use Seattle altimeter setting. 2. Increase all MDAs 80 feet.
ACTIVATE MALSR Rwy 19, and VASI Rwy 1-19-UNICOM.
Circling not authorized west of Rwy 1-19 for Cat. D aircraft.
Alternate minimums NA when control zone not in effect.

Knots	60	90	120	150	180
Min:Sec					

NDB RWY 1

47°30'N – 122°45'W

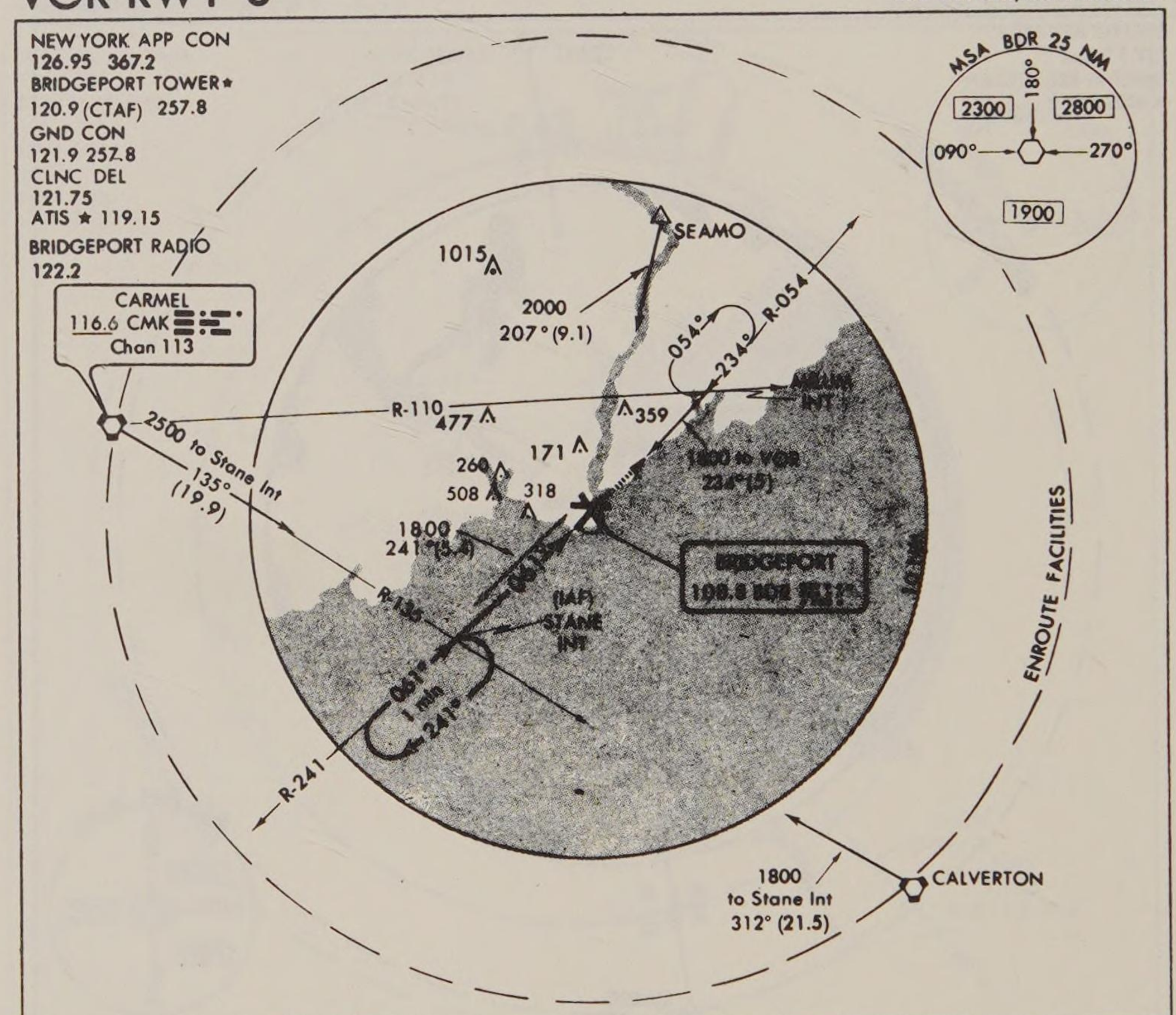
BREMERTON, WASHINGTON
BREMERTON NATIONAL (PWT)

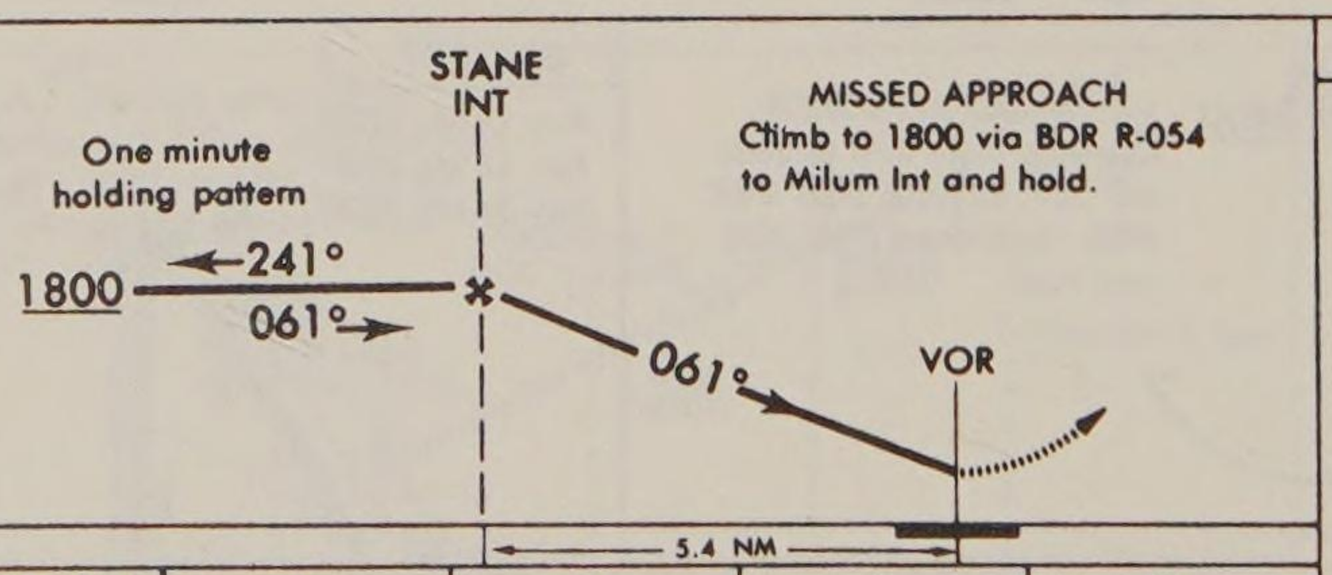
Not for use in Navigation

Amdt 18

VOR RWY 6

BRIDGEPORT/IGOR I. SIKORSKY MEM (BDR)
BRIDGEPORT, CONNECTICUT



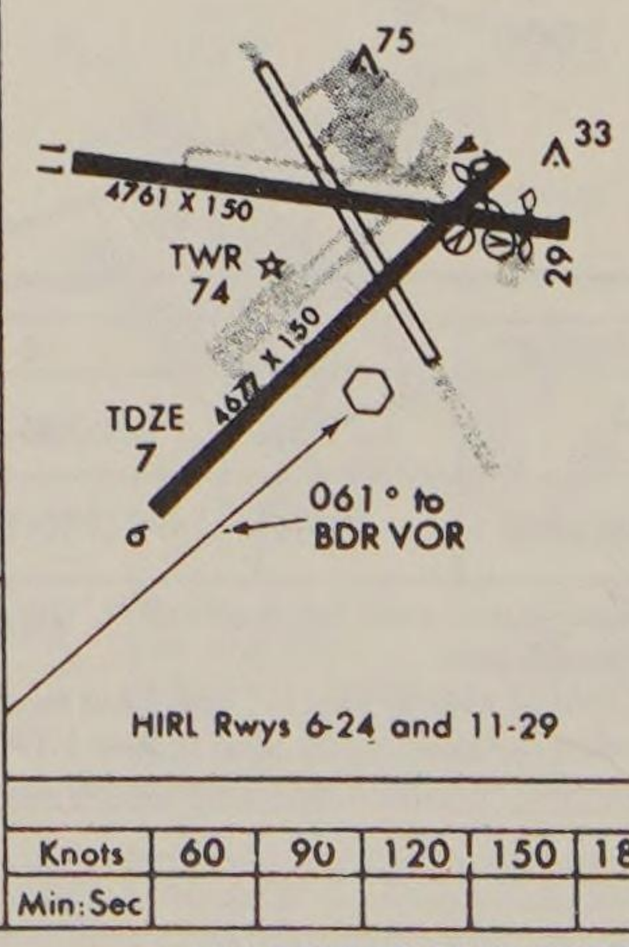


CATEGORY	A	B	C	D
S-6	380-1 373 (400-1)			380-1¼ 373 (400-1¼)
CIRCLING	480-1 470 (500-1)	620-1 610 (700-1)	620-1¾ 610 (700-1¾)	820-2½ 810 (900-2½)

When control zone not in effect: 1. Use Islip altimeter setting. 2. Increase all MDAs 80 feet.

ELEV 10

Rwy 24 ldg 4357′
Rwy 29 ldg 4397′



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 6

41°10′N-73°08′W

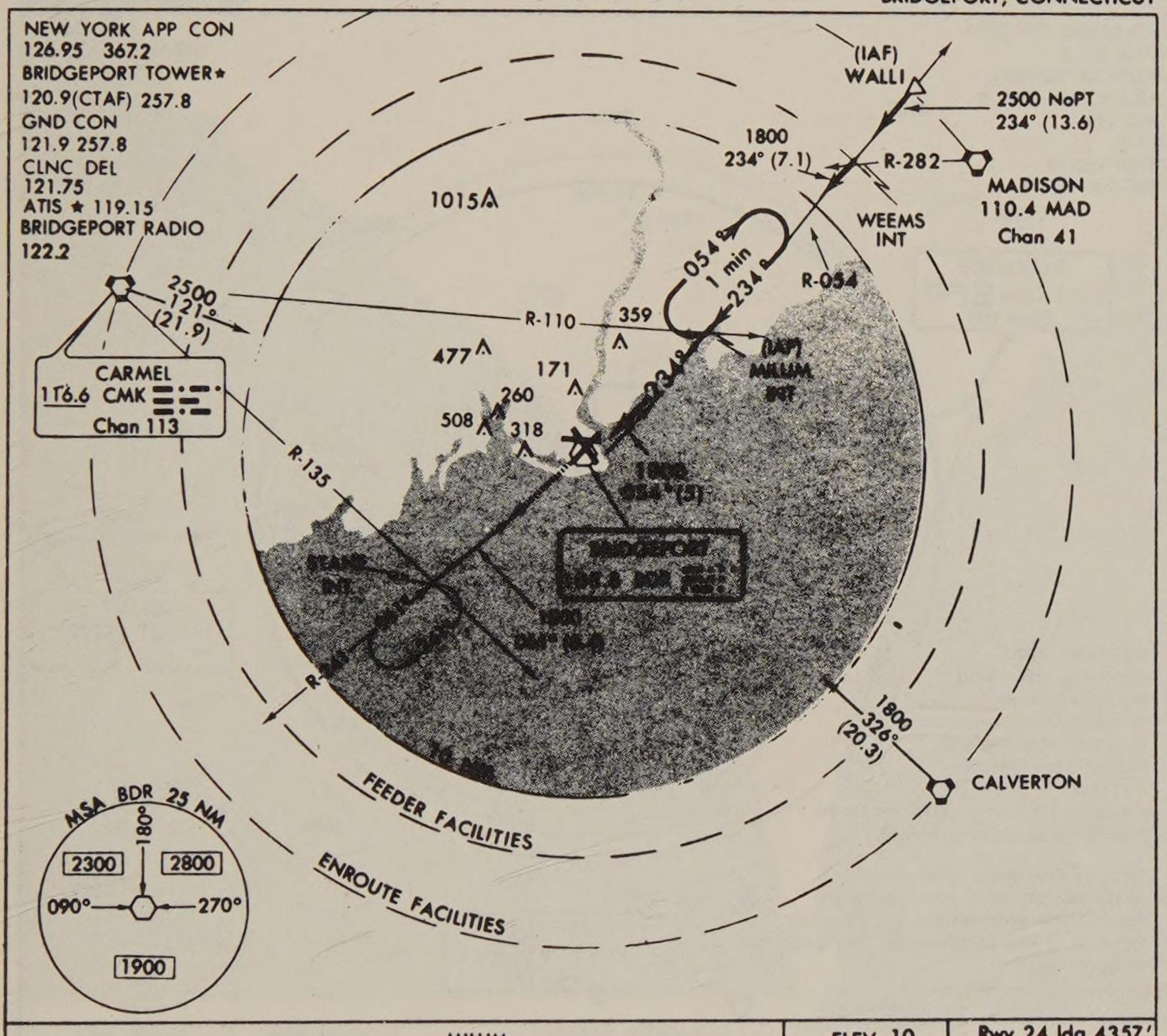
BRIDGEPORT, CONNECTICUT
BRIDGEPORT/IGOR I. SIKORSKY MEM (BDR)

Not for use in Navigation

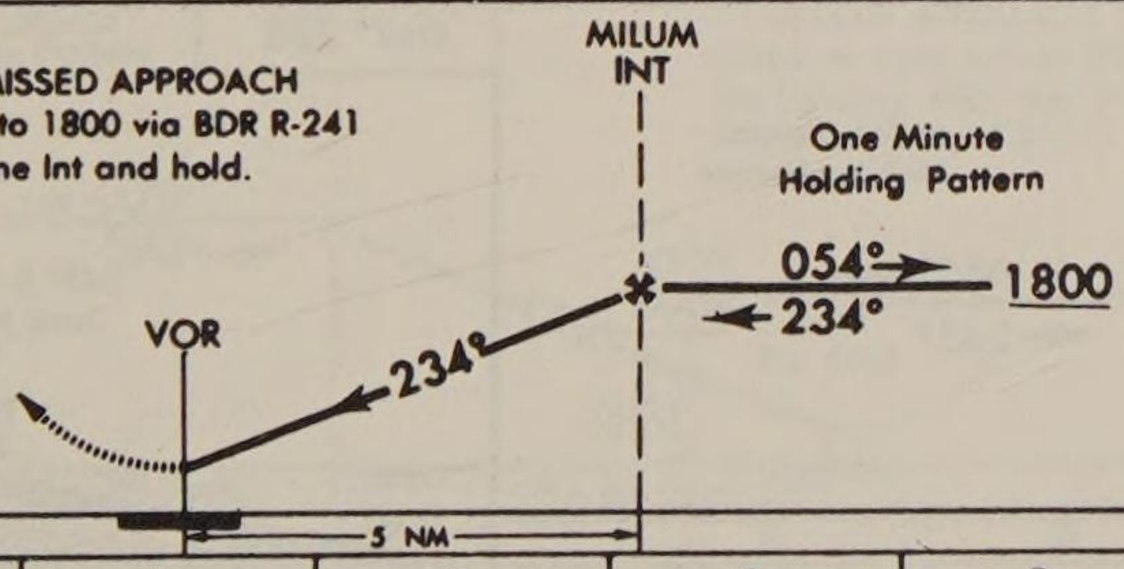
Amdt 11

VOR RWY 24

BRIDGEPORT/IGOR I. SIKORSKY MEM (BDR)
BRIDGEPORT, CONNECTICUT



MISSED APPROACH
Climb to 1800 via BDR R-241
to Stane Int and hold.

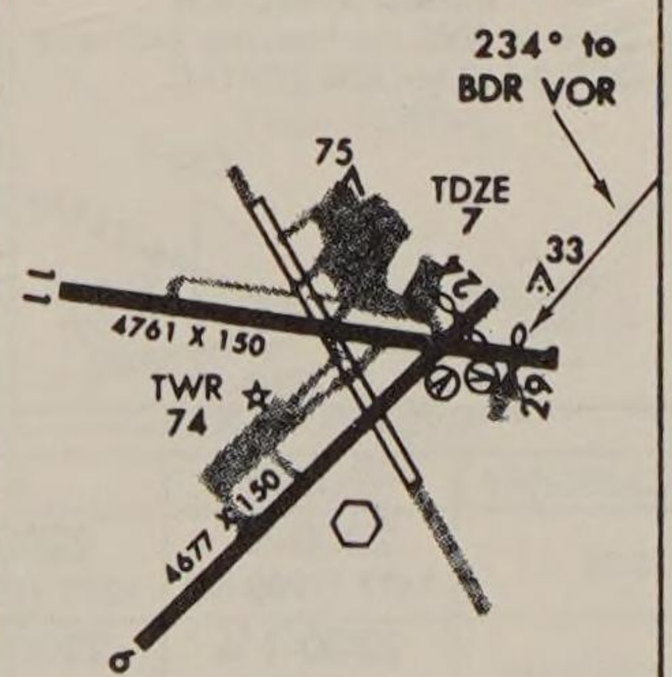


CATEGORY	A	B	C	D
S-24	460-1 453 (500-1)		460-1¼ 453 (500-1¼)	460-1½ 453 (500-1½)
CIRCLING	480-1 470 (500-1)	620-1 610 (700-1)	620-1¾ 610 (700-1¾)	820-2½ 810 (900-2½)

When control zone not in effect: 1. Use Islip altimeter setting. 2. Increase all MDAs 80 feet.

ELEV 10

Rwy 24 ldg 4357'
Rwy 29 ldg 4397'



HIRL Rwys 6-24 and 11-29

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 24

41°10'N – 73°08'W

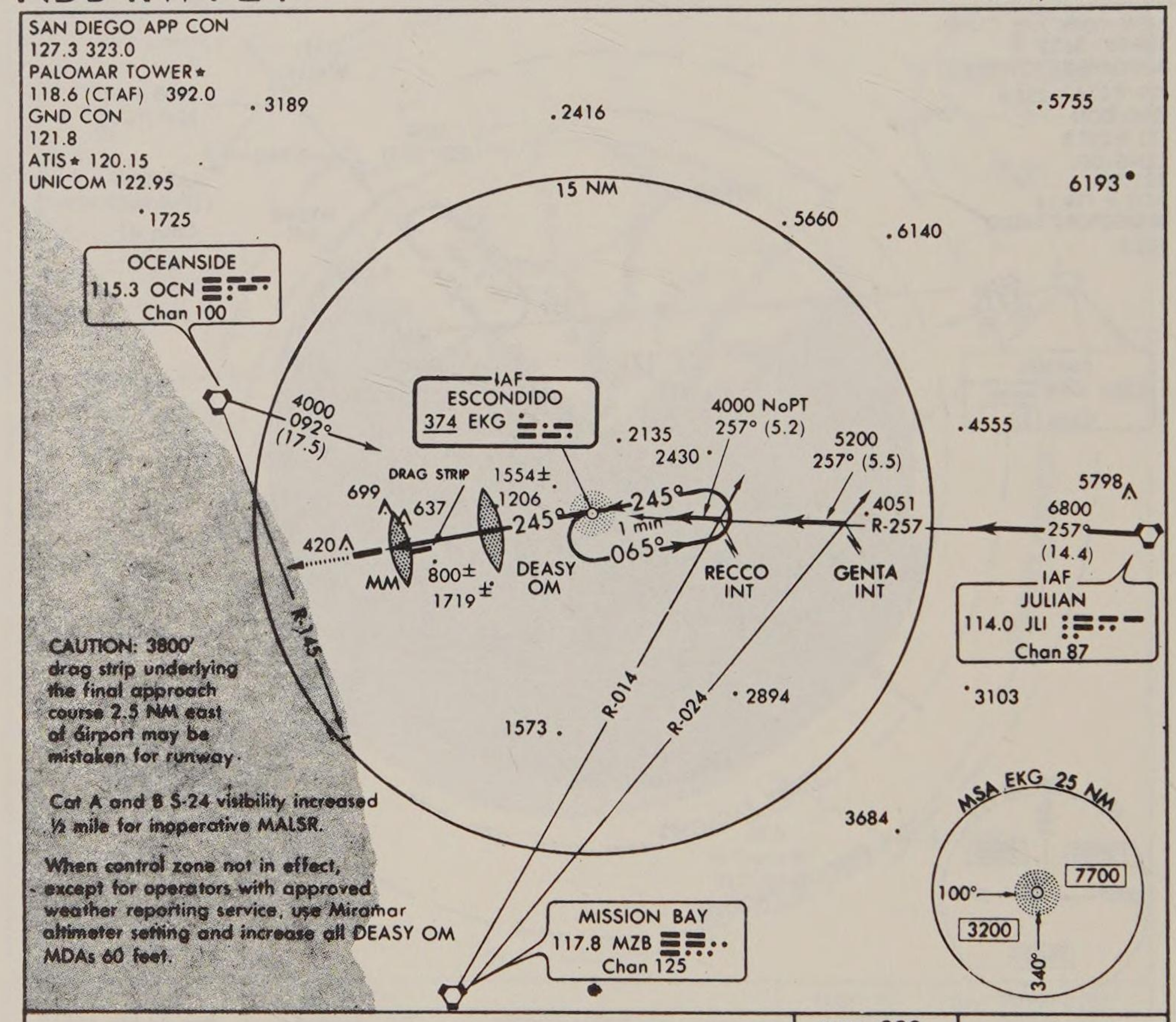
BRIDGEPORT, CONNECTICUT
BRIDGEPORT/IGOR I. SIKORSKY MEM (BDR)

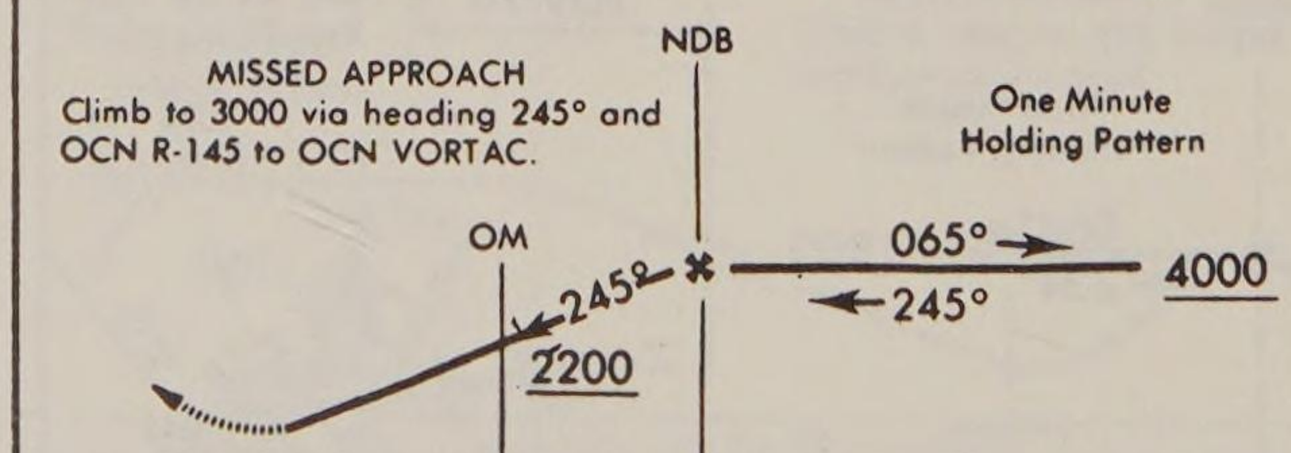
Not for use in Navigation

Amdt 3

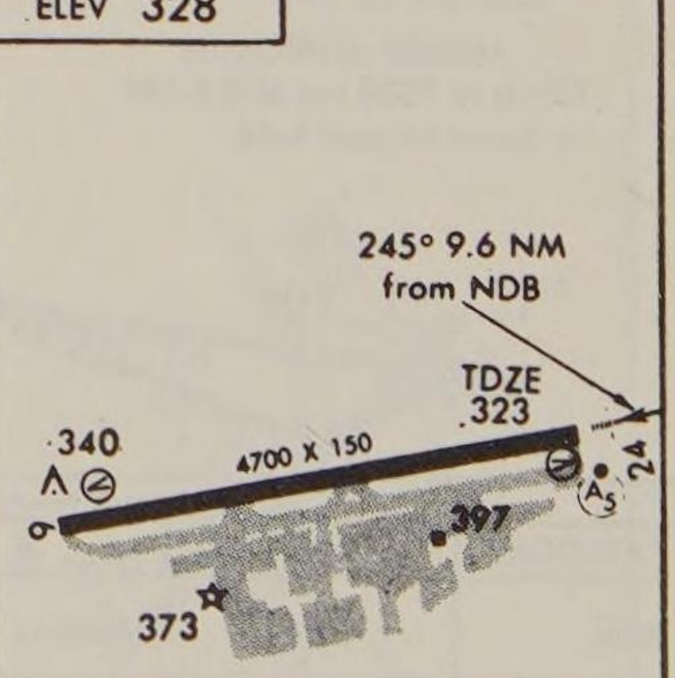
NDB RWY 24

CARLSBAD/MC CLELLAN-PALOMAR (CRQ)
CARLSBAD, CALIFORNIA





ELEV 328



CATEGORY	A	B	C	D
S-24	2200-¾ 1877 (1900-¾)	2200-1 1877 (1900-1)	2200-2½ 1877 (1900-2½)	NA
CIRCLING	2200-1¼ 1872 (1900-1¼)	2200-1½ 1872 (1900-1½)	2200-3 1872 (1900-3)	NA
DEASY OM MINIMUMS				
S-24	1760-¾ 1437 (1500-¾)	1760-1 1437 (1500-1)	1760-2½ 1437 (1500-2½)	NA
CIRCLING	1760-1¼ 1432 (1500-1¼)	1760-1½ 1432 (1500-1½)	1760-3 1432 (1500-3)	NA
ACTIVATE MALSR Rwy 24-118.6 ▽△				

REIL Rwy 24
MIRL Rwy 6-24

FAF to MAP 9.6 NM

Knots	60	90	120	150	180
Min:Sec	9:36	6:24	4:48	3:50	3:12

NDB RWY 24

33°08'N – 117°17'W

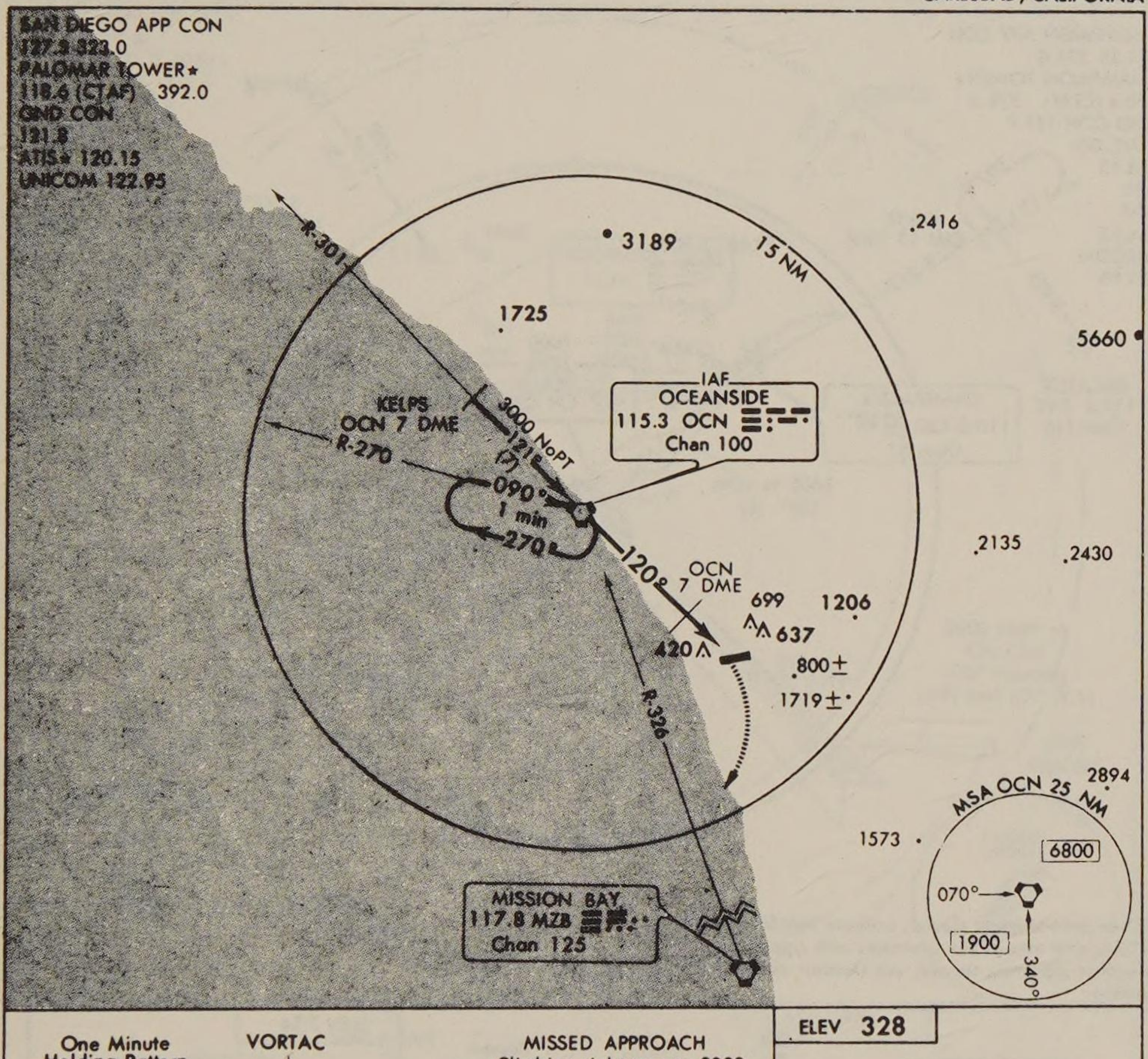
CARLSBAD, CALIFORNIA
CARLSBAD/MC CLELLAN-PALOMAR (CRQ)

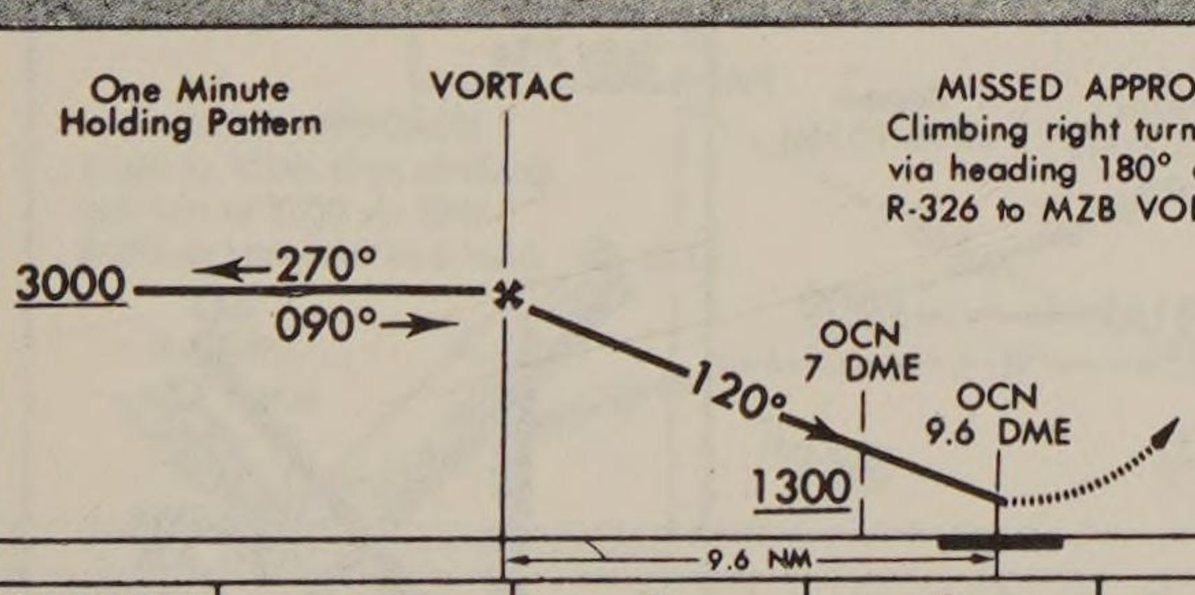
Not for use in Navigation

Amdt 6

VOR-A

CARLSBAD/MC CLELLAN-PALOMAR (CRQ)
CARLSBAD, CALIFORNIA

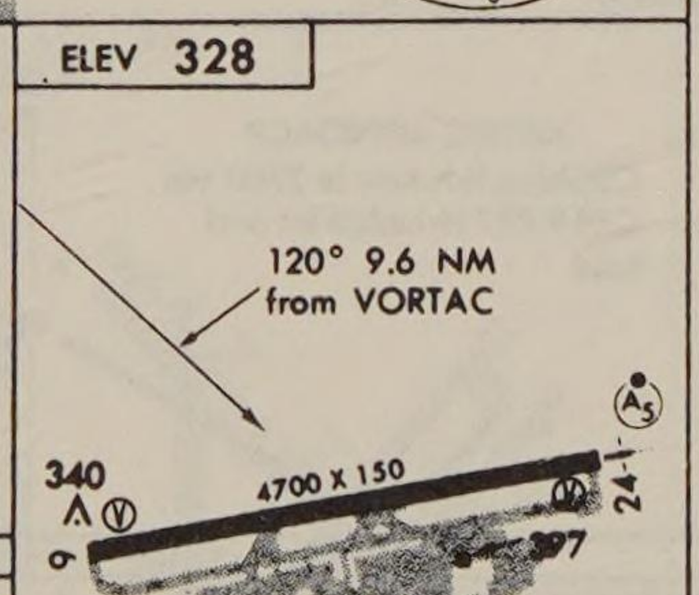




CATEGORY	A	B	C	D
CIRCLING	1300-1 ¼ 972 (1000-1 ¼)	1300-1 ½ 972 (1000-1 ½)	1300-3 972 (1000-3)	NA
DME MINIMA				
CIRCLING	860-1 532 (600-1)	1000-1 672 (700-1)	1000-2 672 (700-2)	NA

When control zone not in effect, except for operators with approved weather reporting service, use Miramar altimeter setting and increase all DME minimums 80 feet.

ACTIVATE MALSR Rwy 24-118.6



REIL Rwy 24
MIRL Rwy 6-24

FAF to MAP 9.6 NM					
Knots	60	90	120	150	180
Min:Sec	9:36	6:24	4:48	3:50	3:12

VOR-A

33°08'N–117°17'W

CARLSBAD, CALIFORNIA
CARLSBAD/MC CLELLAN-PALOMAR (CRQ)

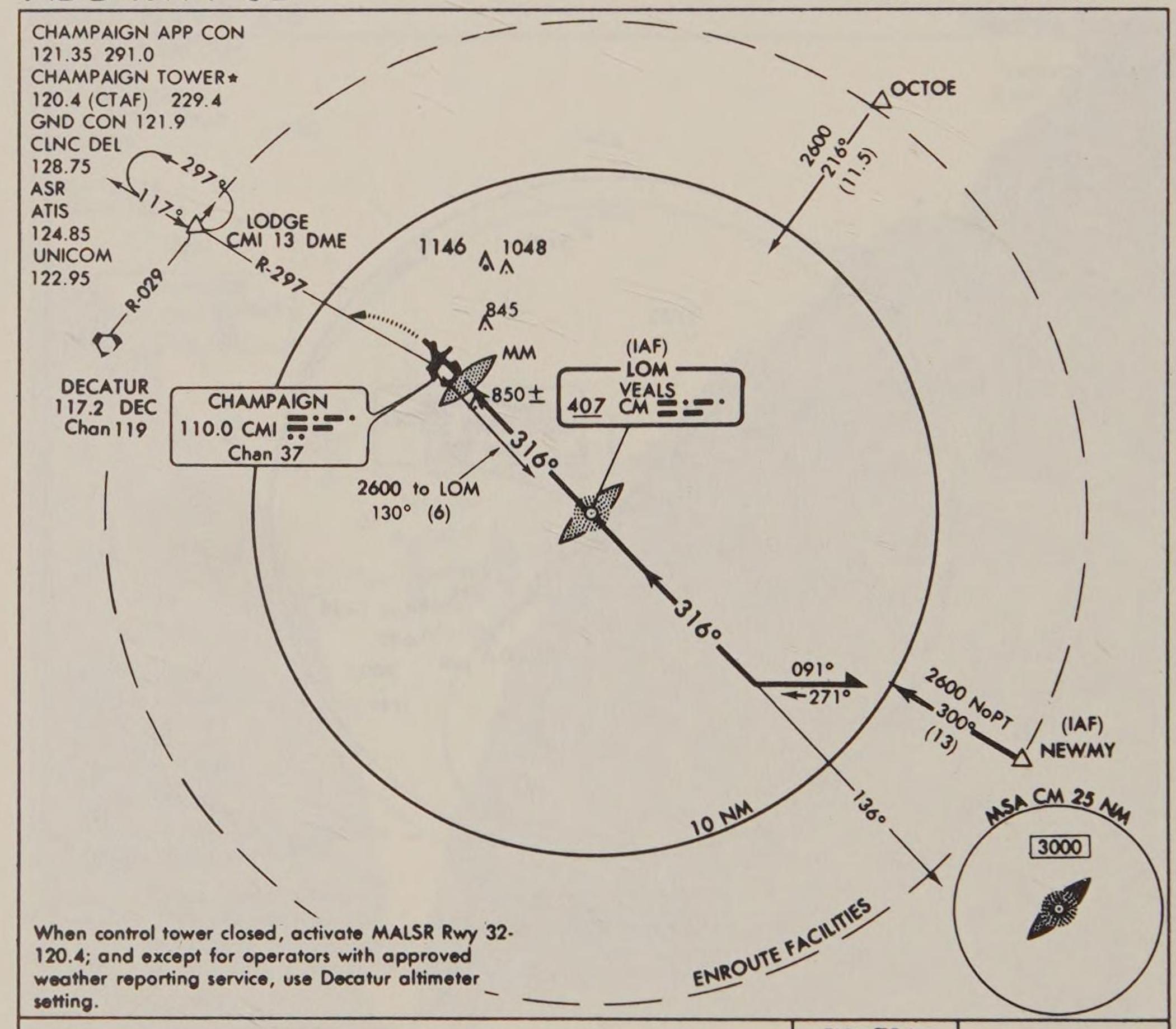
Not for use in Navigation

Amdt 9

NDB RWY 32

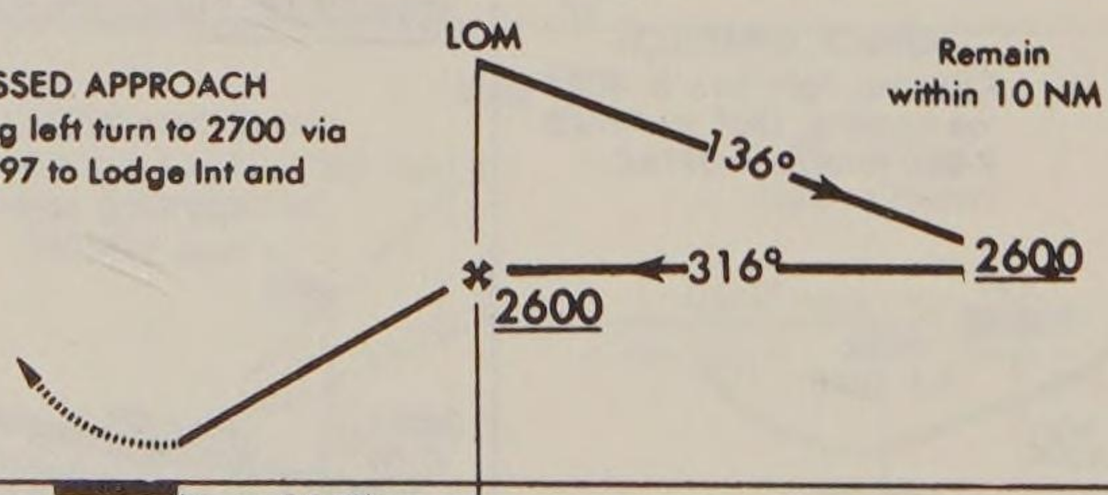
CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)

CHAMPAIGN-URBANA, ILLINOIS



When control tower closed, activate MALSR Rwy 32-120.4; and except for operators with approved weather reporting service, use Decatur altimeter setting.

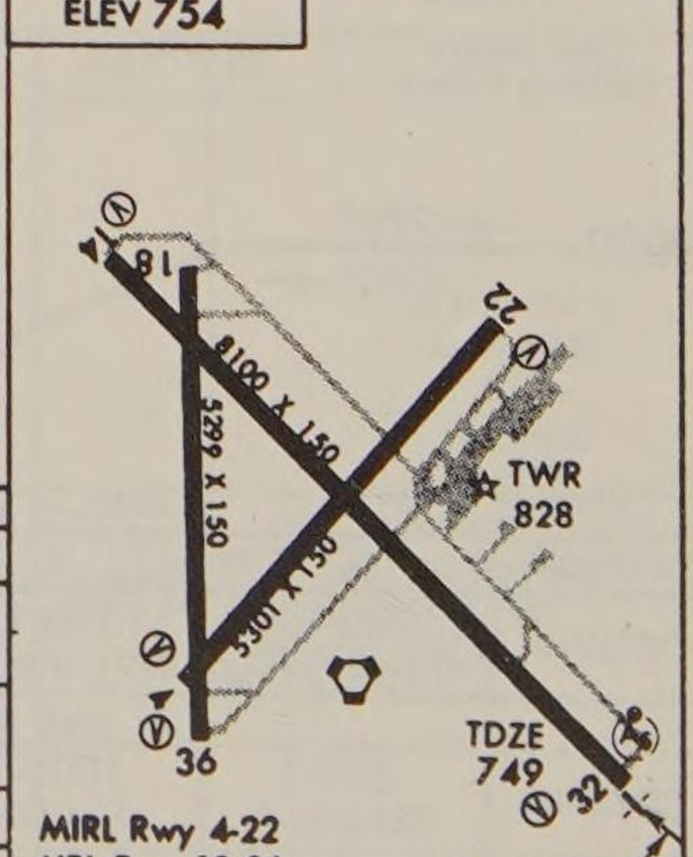
MISSED APPROACH
Climbing left turn to 2700 via CMI R-297 to Lodge Int and hold.



CATEGORY	A	B	C	D
S-32	1160/40 411 (500-¾)			1160/50 411 (500-1)
CIRCLING	1160-1 406 (500-1)	1220-1 466 (500-1)	1220-1½ 466 (500-1½)	1320-2 566 (600-2)
DECATUR ALTIMETER SETTING MINIMUMS				
S-32	1280/40 531 (600-¾)			1280/50 531 (600-1)
CIRCLING	1280-1 526 (600-1)		1280-1½ 526 (600-1½)	1320-2 566 (600-2)

⚠ NA

ELEV 754



MIRL Rwy 4-22
LIRL Rwy 18-36
HIRL Rwy 14-32
REIL Rwys 4, 14 and 22

FAF to MAP 5.5 NM					
Knots	60	90	120	150	180
Min:Sec	5:30	3:40	2:45	2:12	1:50

NDB RWY 32

40°02'N-88°17'W

CHAMPAIGN-URBANA, ILLINOIS

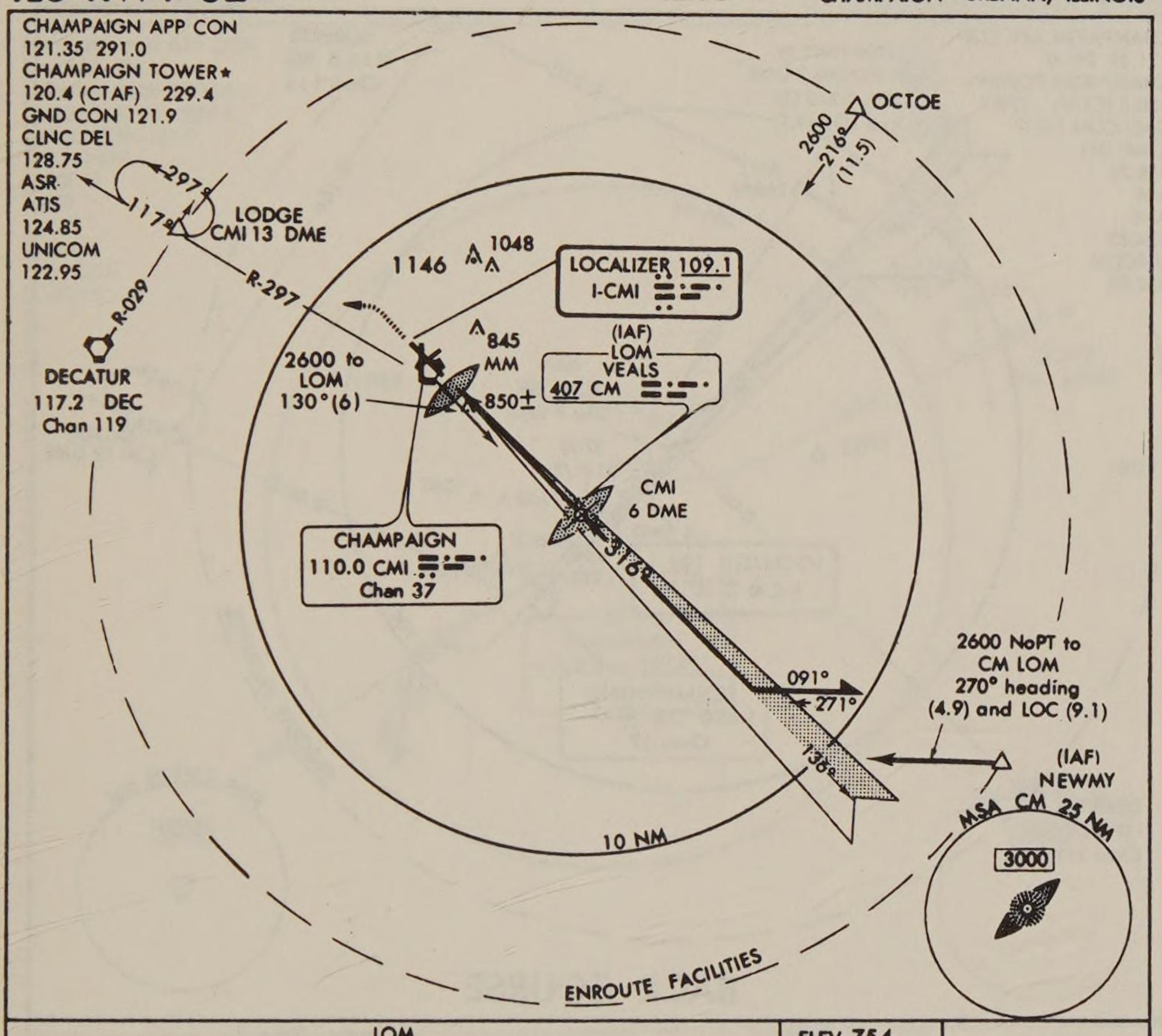
CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)

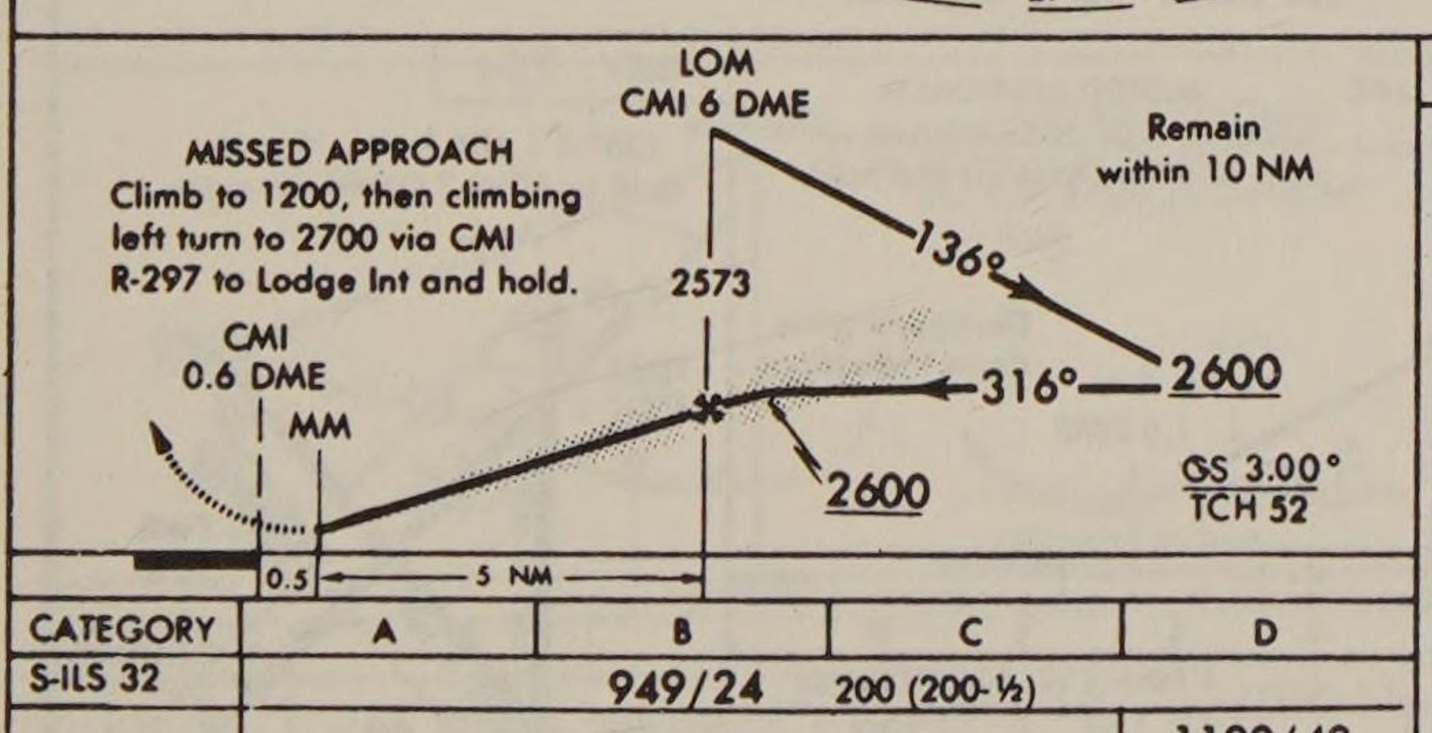
Not for use in Navigation

Amdt 10

ILS RWY 32

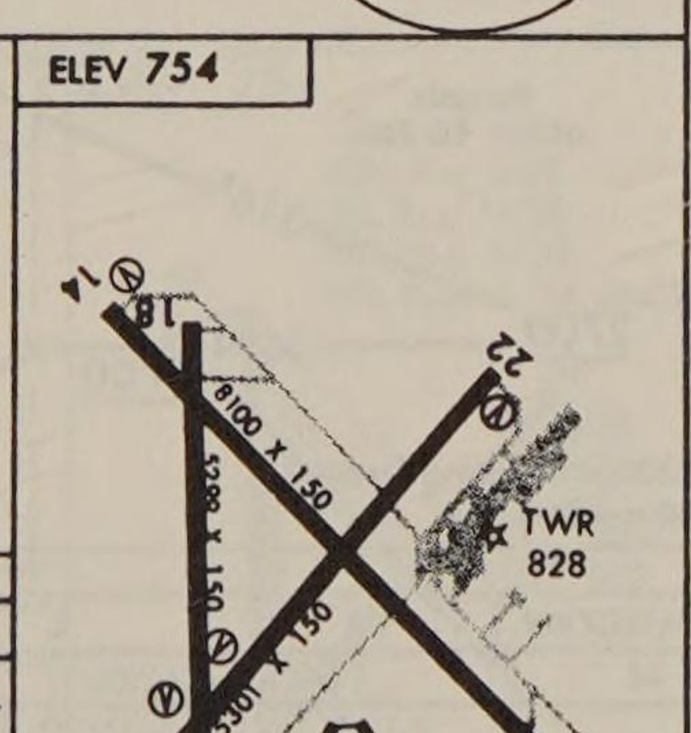
CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)
CHAMPAIGN – URBANA, ILLINOIS





CATEGORY	A	B	C	D
S-ILS 32	949/24 200 (200-½)			
S-LOC 32	1100/24 351 (400-½)			1100/40 351 (400-¾)
CIRCLING	1160-1 406 (500-1)	1220-1 466 (500-1)	1220-1½ 466 (500-1½)	1320-2 566 (600-2)

Cat. D S-LOC visibility increased to RVR 5000 for inoperative MM.
When control tower closed, activate MALSR Rwy 32-120.4; and, except for operators with approved weather reporting service, use Decatur altimeter setting and increase all DH/MDAs 140 feet.
Ⓐ



FAF to MAP 5.5 NM					
Knots	60	90	120	150	180
Min:Sec	5:30	3:40	2:45	2:12	1:50

ILS RWY 32

40°02'N – 88°17'W
CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD CMI)

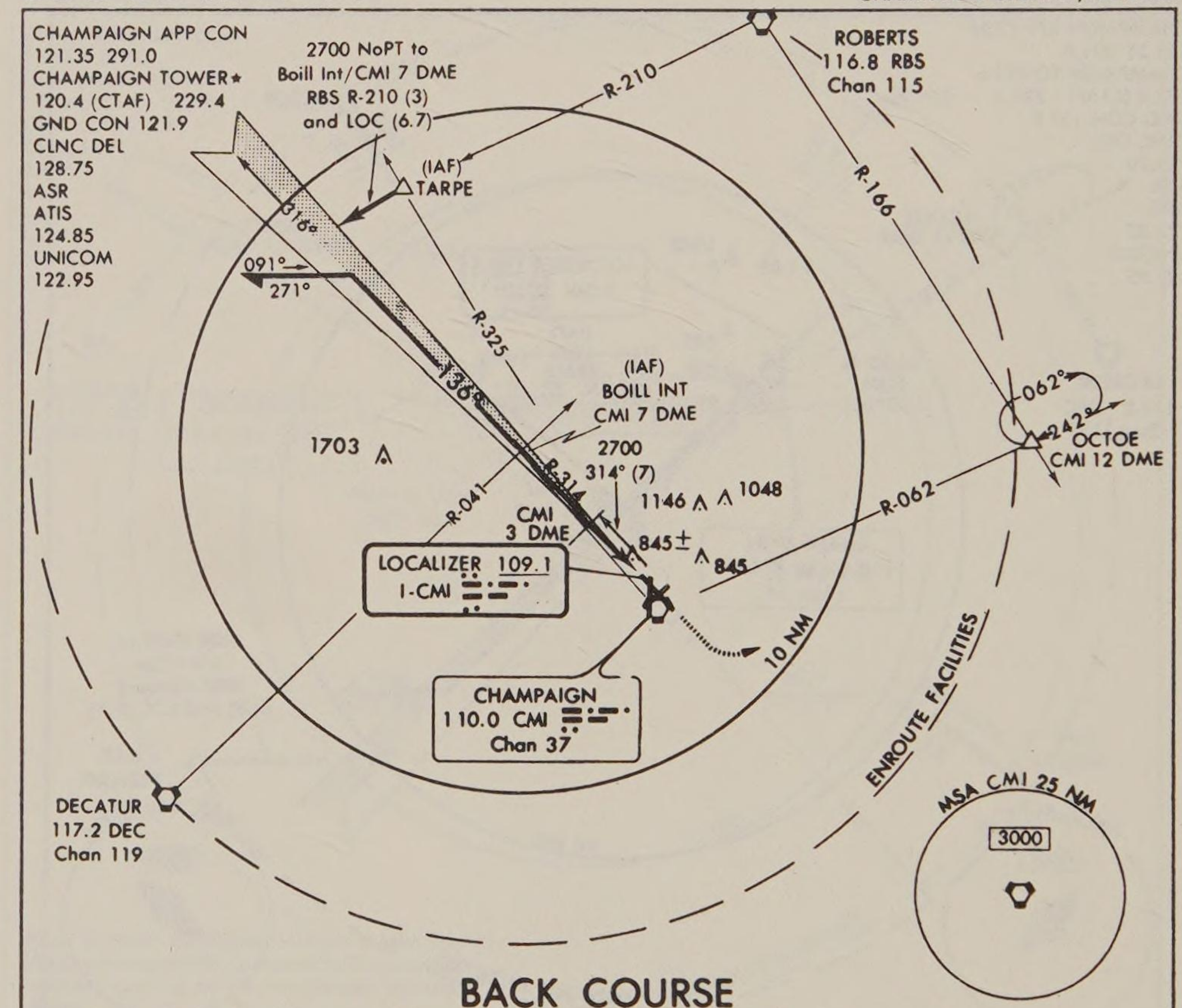
CHAMPAIGN–URBANA, ILLINOIS

Not for use in Navigation

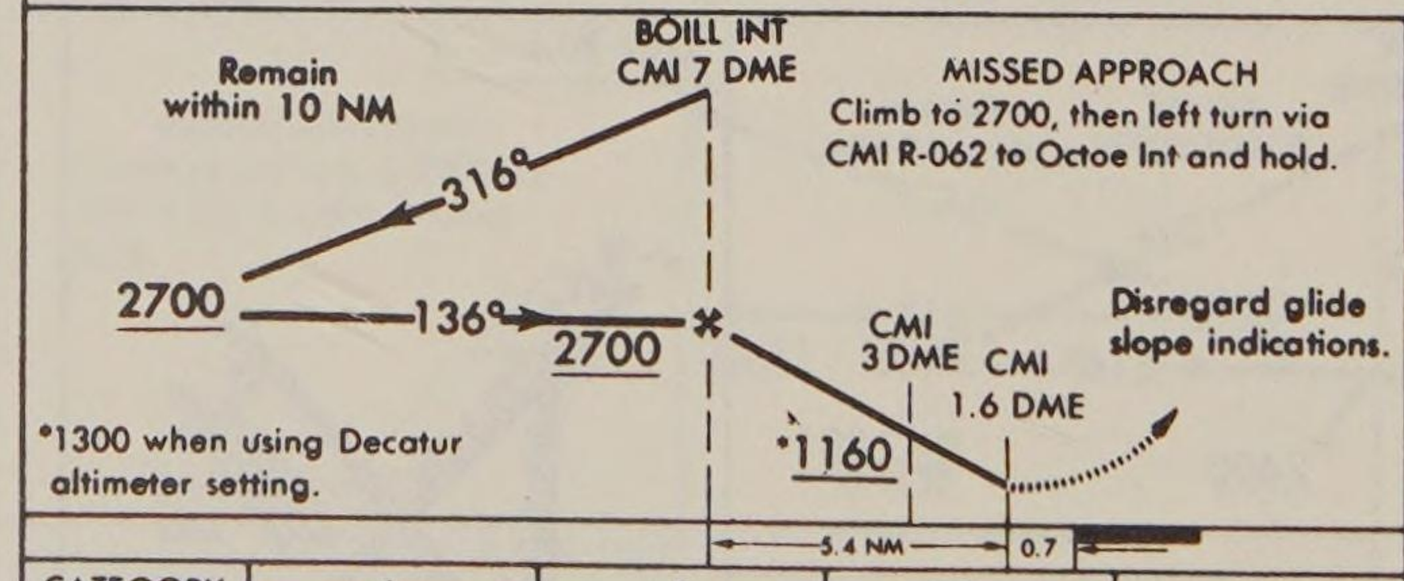
Amdt 6

LOC BC RWY 14

CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)
CHAMPAIGN-URBANA, ILLINOIS

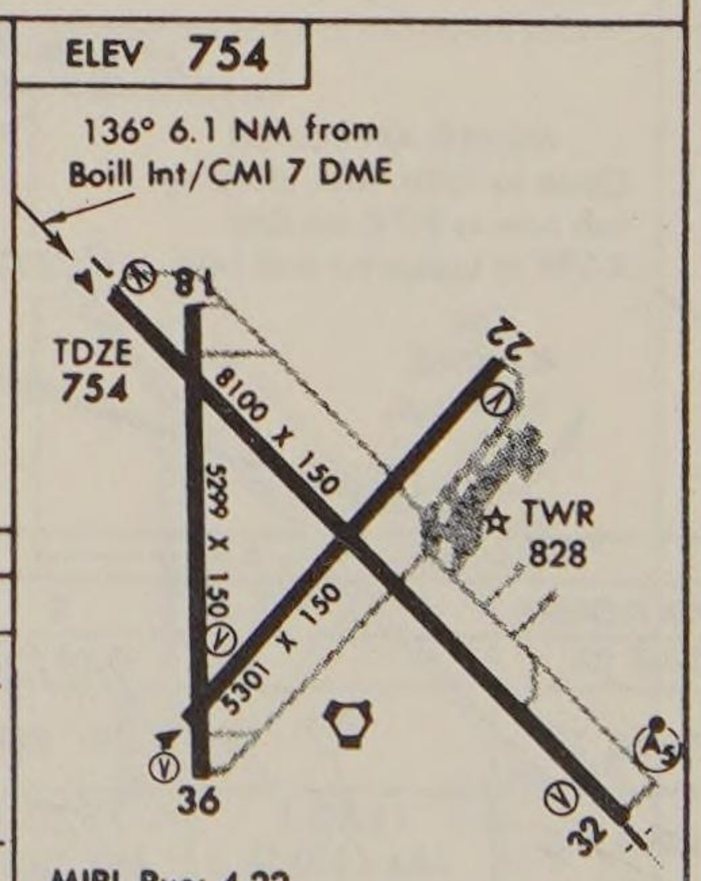


BACK COURSE



CATEGORY	A	B	C	D
S-14	1160-1 406 (500-1)		1160-1¼ 406 (500-1¼)	
CIRCLING	1160-1 406 (500-1)	1220-1 466 (500-1)	1220-1½ 466 (500-1½)	1320-2 566 (600-2)
DME MINIMUMS				
S-14	1100-1 346 (400-1)			1100-1¼ 346 (400-1¼)

When control tower closed, activate MALSR Rwy 32-120.4; and, except for operators with approved weather reporting service, use Decatur altimeter setting and increase all MDAs 140 feet.
Ⓐ



MIRL Rwy 4-22
LIRL Rwy 18-36
HIRL Rwy 14-32
REIL Rwys 4, 14 and 22

FAF to MAP 5.4 NM					
Knots	60	90	120	150	180
Min:Sec	5:24	3:36	2:42	2:10	1:48

LOC BC RWY 14

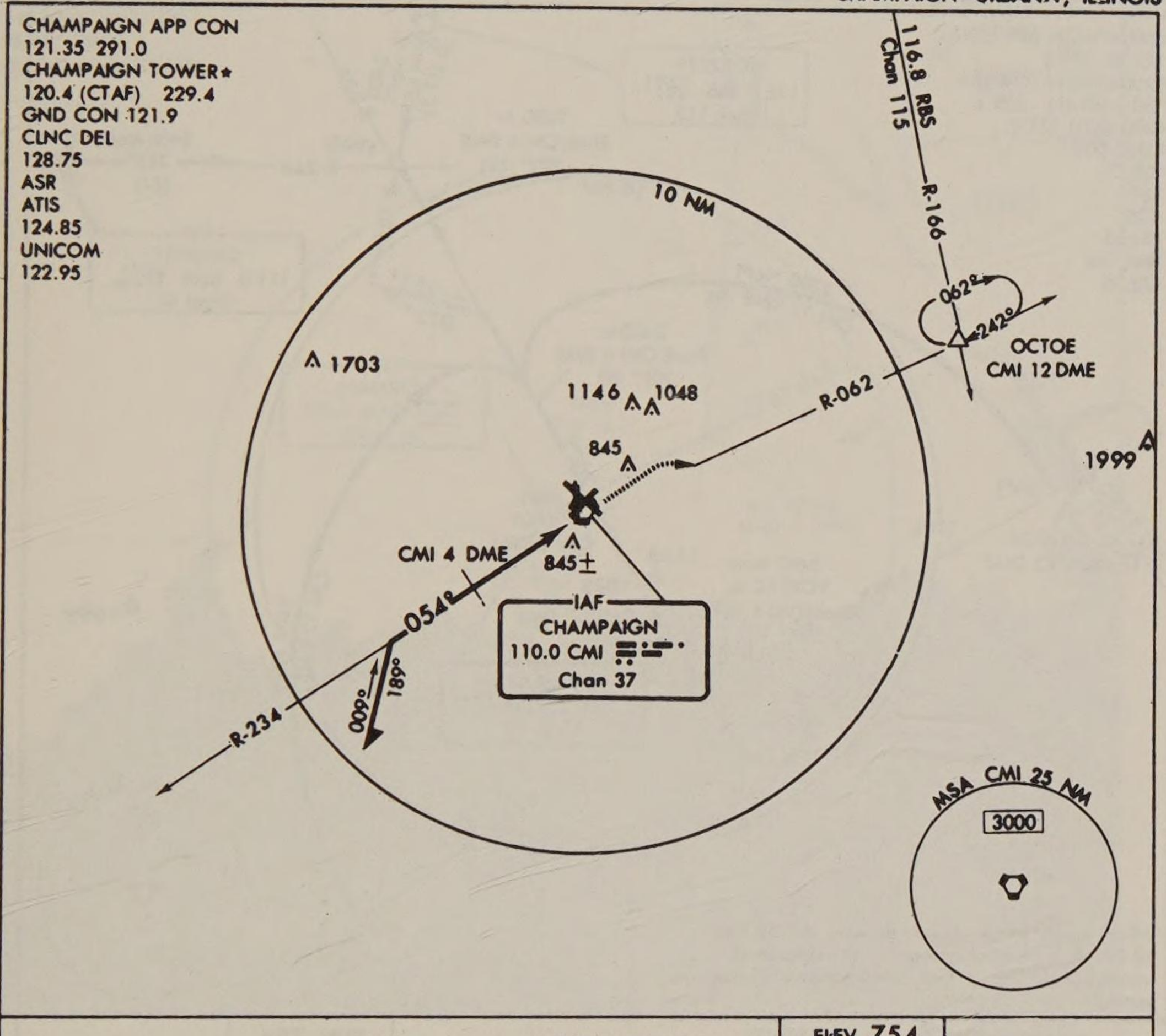
40°02'N – 88°17'W
CHAMPAIGN-URBANA, ILLINOIS
CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)

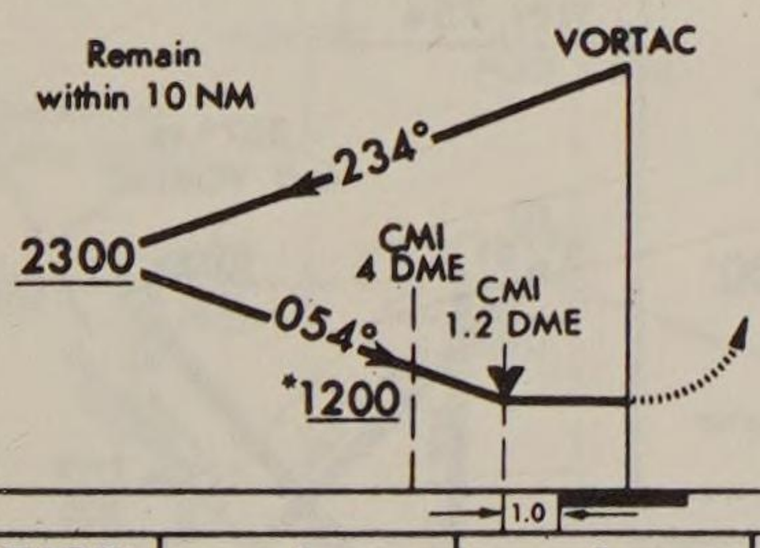
Not for use in Navigation

Amdt 9

VOR RWY 4

CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)
CHAMPAIGN-URBANA, ILLINOIS



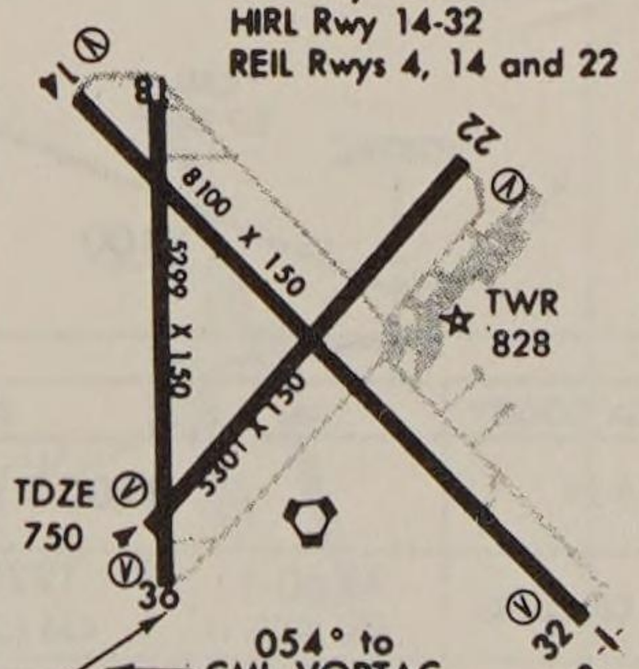


MISSED APPROACH
Climb to 2700, then right turn via CMI R-062 to Octoe Int and hold.

*1340 when using Decatur altimeter setting.

ELEV 754

MIRL Rwy 4-22
LIRL Rwy 18-36
HIRL Rwy 14-32
REIL Rwys 4, 14 and 22



CATEGORY	A	B	C	D
S-4	1200-1 450 (500-1)		1200-1¼ 450 (500-1¼)	1200-1½ 450 (500-1½)
CIRCLING	1200-1 446 (500-1)	1220-1 466 (500-1)	1220-1½ 466 (500-1½)	1320-2 566 (600-2)
DME MINIMUMS				
S-4	1100-1 350 (400-1)			1100-1¼ 350 (400-1¼)

When control tower closed, activate MALSR Rwy 32-120.4; except for operators with approved weather reporting service, use Decatur altimeter setting and increase all MDAs 140 feet.
A

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 4

40°02'N-88°17'W
CHAMPAIGN-URBANA, ILLINOIS
CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)

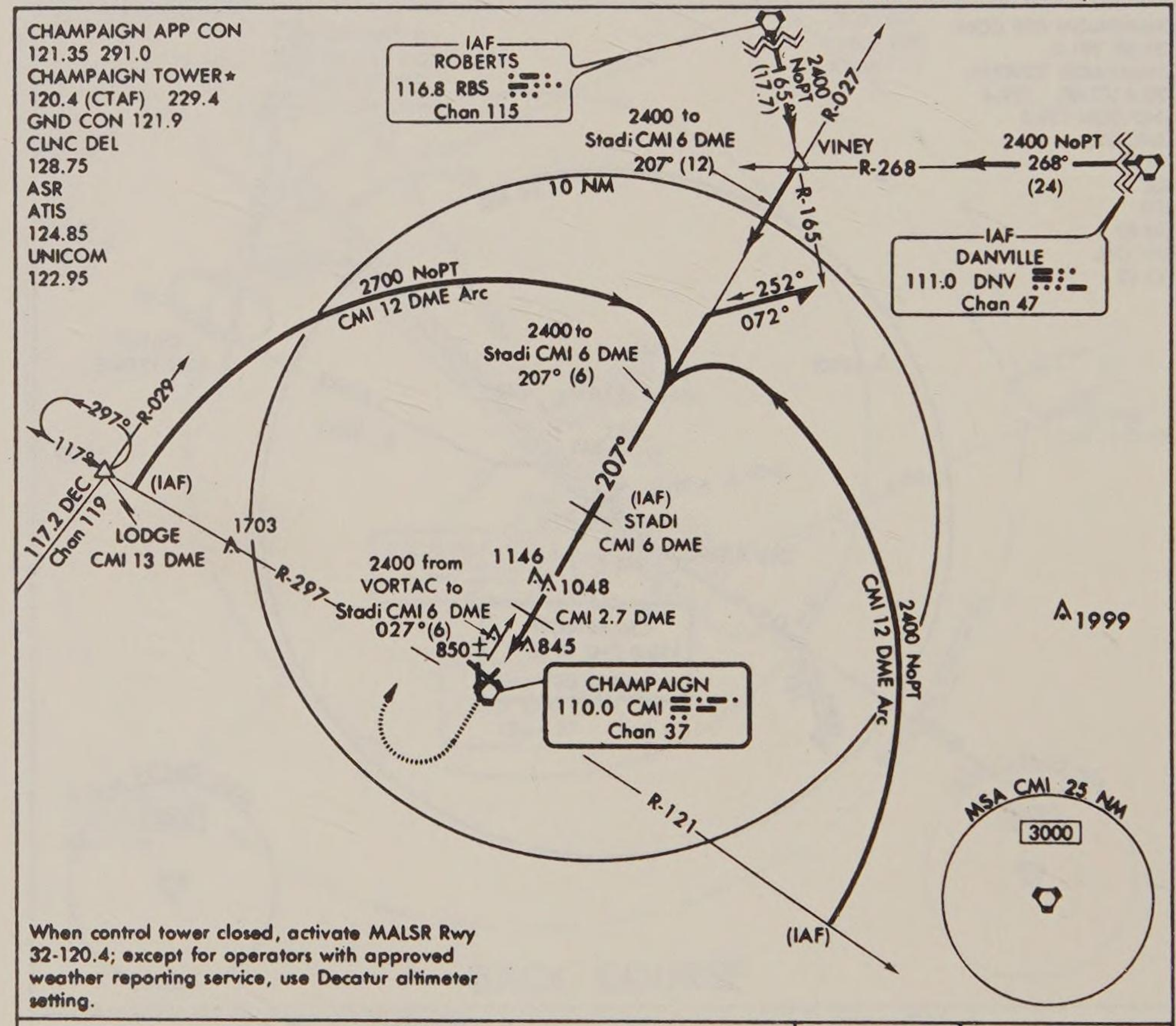
Not for use in Navigation

Amdt 6

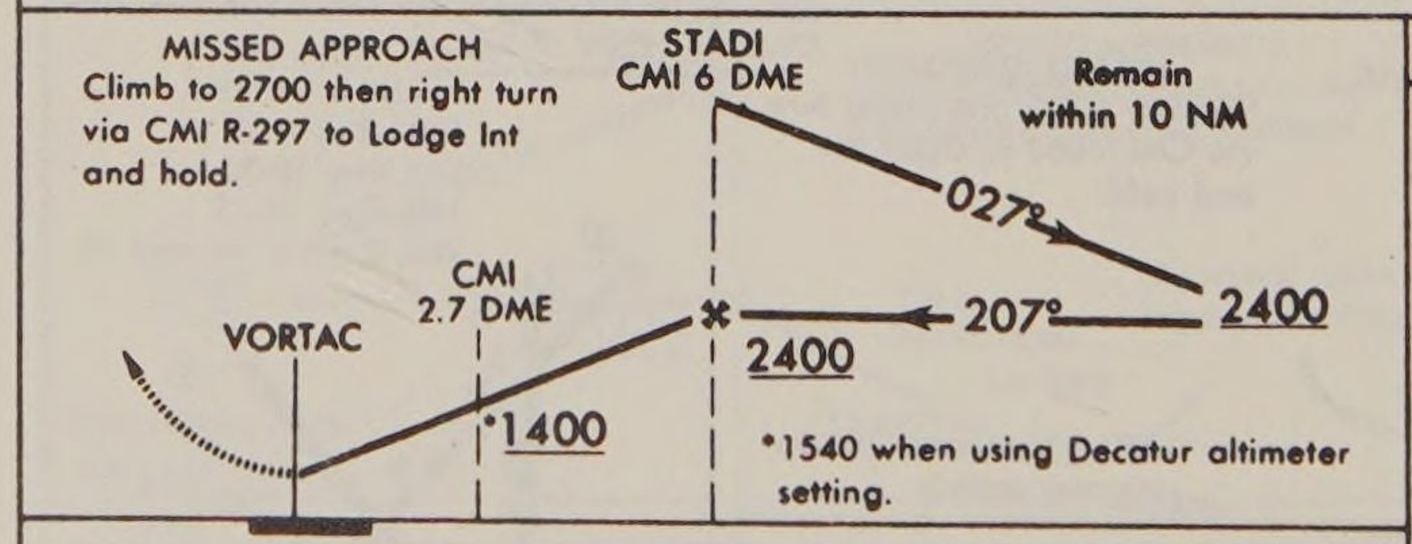
VOR/DME RWY 22

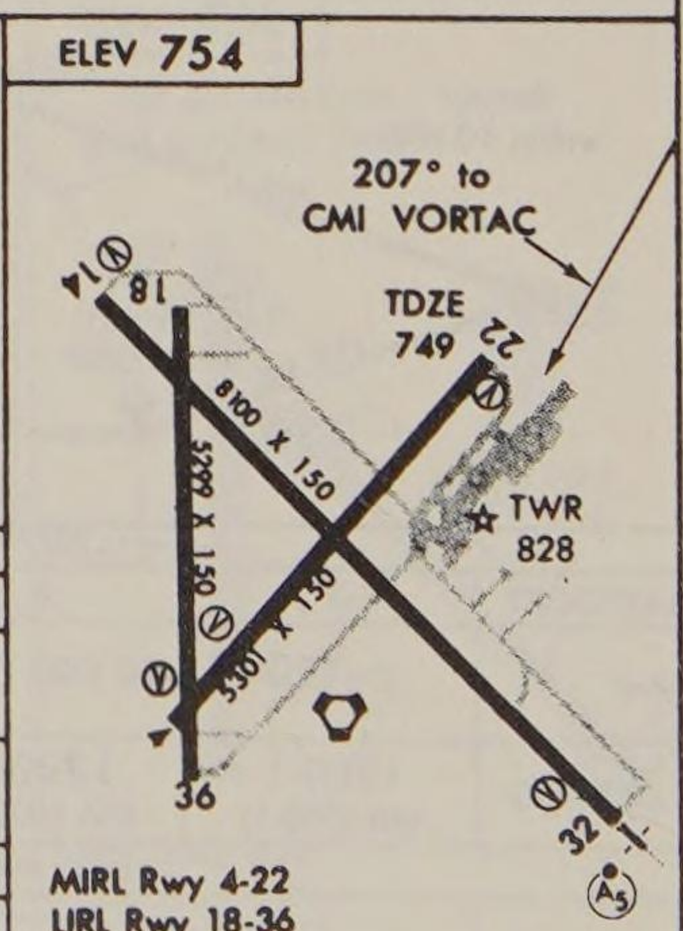
CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)

CHAMPAIGN-URBANA, ILLINOIS



When control tower closed, activate MALSR Rwy 32-120.4; except for operators with approved weather reporting service, use Decatur altimeter setting.





CATEGORY	A	B	C	D
S-22	1100-1 351 (400-1)			1100-1¼ 351 (400-1¼)
CIRCLING	1160-1 406 (500-1)	1220-1 466 (500-1)	1220-1½ 466 (500-1½)	1320-2 566 (600-2)
DECATUR ALTIMETER SETTING MINIMUMS				
S-22	1240-1 491 (500-1)			1240-1¼ 491 (500-1¼)
CIRCLING	1280-1 526 (600-1)		1280-1½ 526 (600-1½)	1320-2 566 (600-2)

Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 22

40°02'N-88°17'W

CHAMPAIGN-URBANA/UNIVERSITY OF ILLINOIS-WILLARD (CMI)

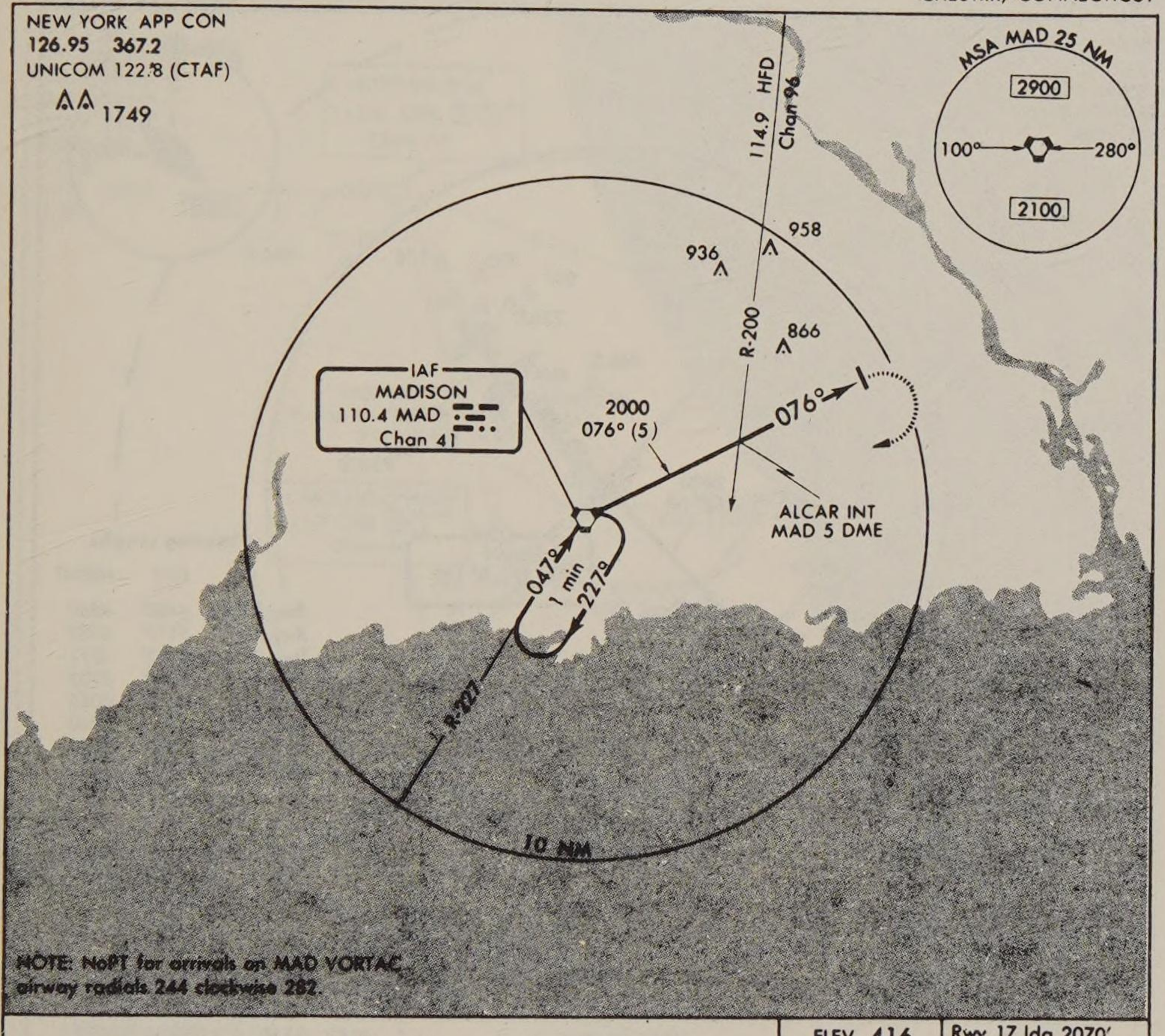
CHAMPAIGN-URBANA, ILLINOIS

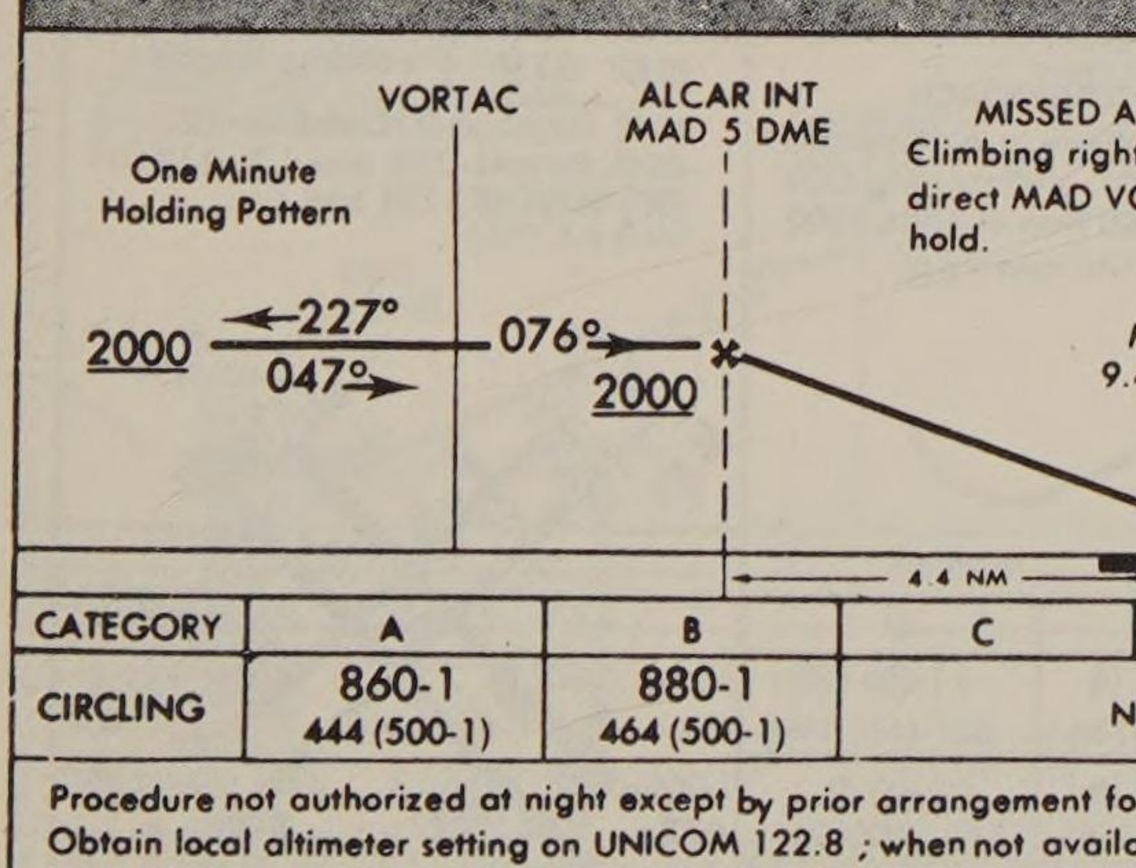
Not for use in Navigation

Amdt 2

VOR-A

CHESTER (3B9)
CHESTER, CONNECTICUT





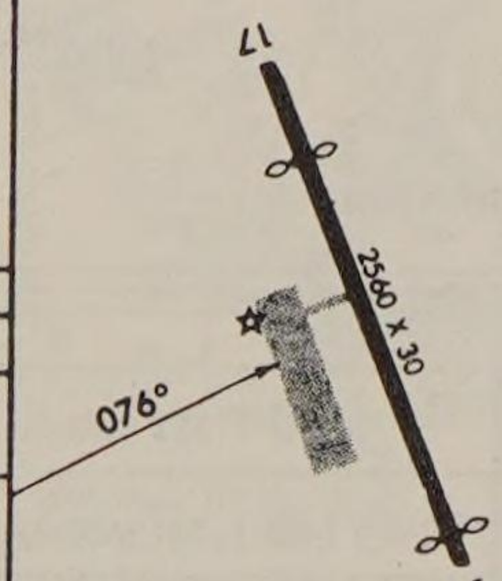
CATEGORY	A	B	C	D
CIRCLING	860-1 444 (500-1)	880-1 464 (500-1)	NA	

Procedure not authorized at night except by prior arrangement for runway lights. Obtain local altimeter setting on UNICOM 122.8 ; when not available use Windsor Locks altimeter setting and increase all MDAs 160 feet.

ⒶNA

ELEV 416

Rwy 17 ldg 2070'
Rwy 35 ldg 2390'



LIRL Rwy 17-35

FAF to MAP 4.4 NM					
Knots	60	90	120	150	180
Min:Sec	4:24	2:56	2:12	1:46	1:28

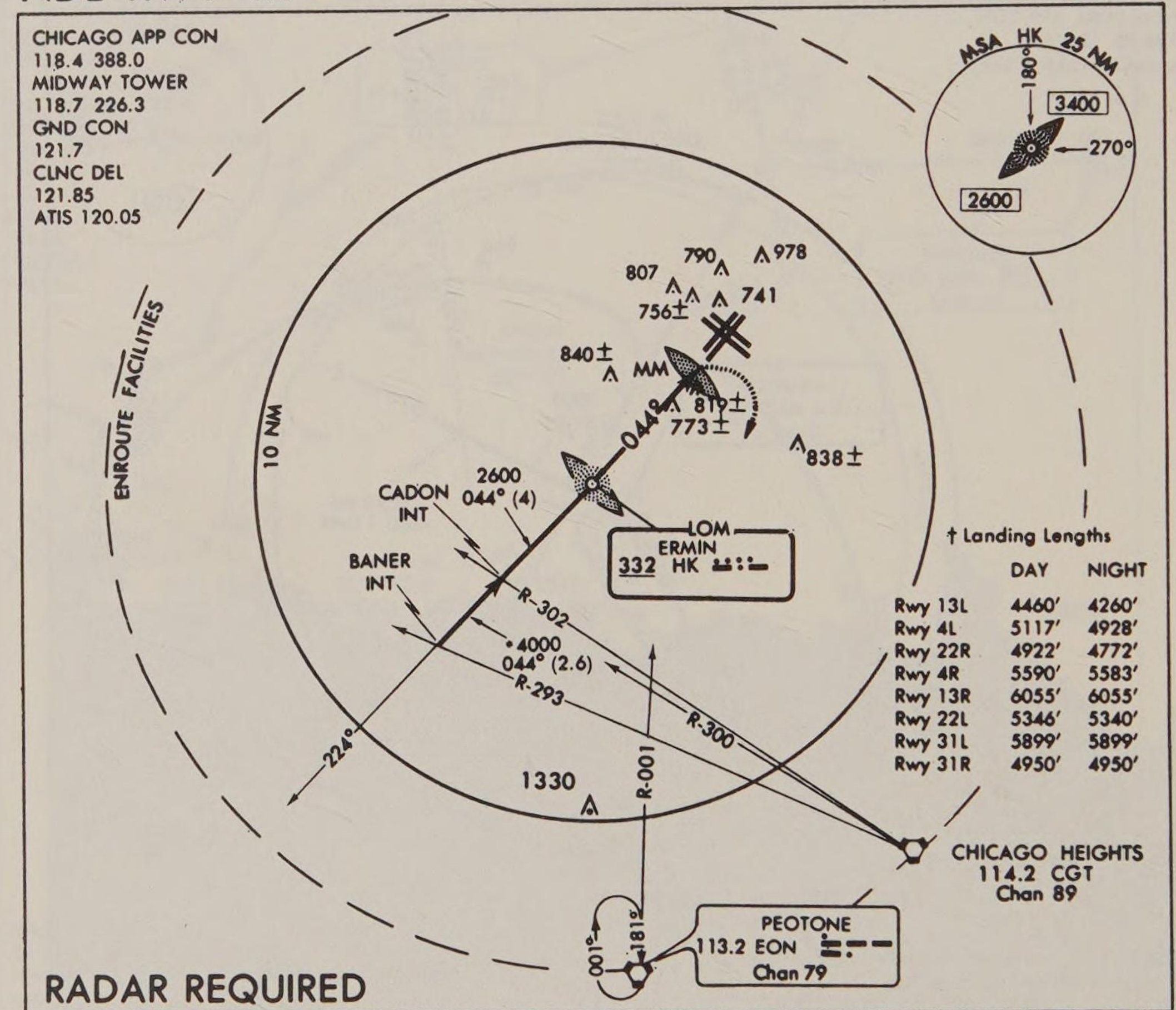
Not for use in Navigation

Amdt 12

NDB RWY 4R

CHICAGO MIDWAY(MDW)
CHICAGO, ILLINOIS

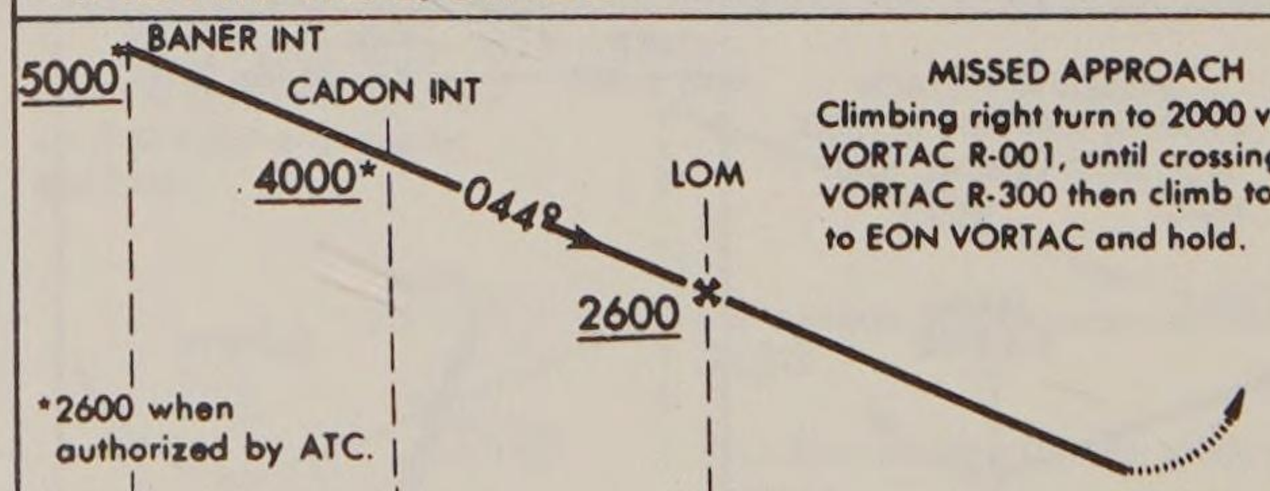
CHICAGO APP CON
118.4 388.0
MIDWAY TOWER
118.7 226.3
GND CON
121.7
CLNC DEL
121.85
ATIS 120.05



† Landing Lengths

	DAY	NIGHT
Rwy 13L	4460′	4260′
Rwy 4L	5117′	4928′
Rwy 22R	4922′	4772′
Rwy 4R	5590′	5583′
Rwy 13R	6055′	6055′
Rwy 22L	5346′	5340′
Rwy 31L	5899′	5899′
Rwy 31R	4950′	4950′

RADAR REQUIRED



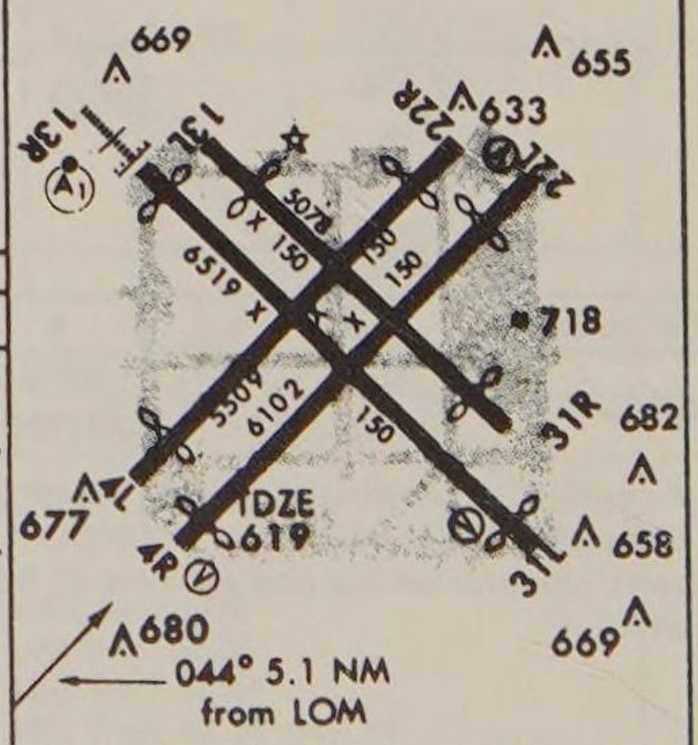
MISSED APPROACH
Climbing right turn to 2000 via EON VORTAC R-001, until crossing CGT VORTAC R-300 then climb to 2600 to EON VORTAC and hold.

CATEGORY	A	B	C	D
S-4R	1140-1 521 (600-1)		1140-1½ 521 (600-1½)	1140-1¾ 521 (600-1¾)
CIRCLING	1140-1 521 (600-1)		1140-1½ 521 (600-1½)	1180-2 561 (600-2)

Air carrier landing visibility reduction for local conditions not authorized.

ELEV 619 | Landing lengths †

HIRL Rwys13R-31L and 4R-22L
MIRL Rwys4L-22R and 13L-31R
REIL Rwys 4R, 22L and 31L



FAF to MAP 5.1 NM					
Knots	60	90	120	150	180
Min:Sec	5:06	3:24	2:33	2:02	1:42

NDB RWY 4R

41°47′N – 87°45′W

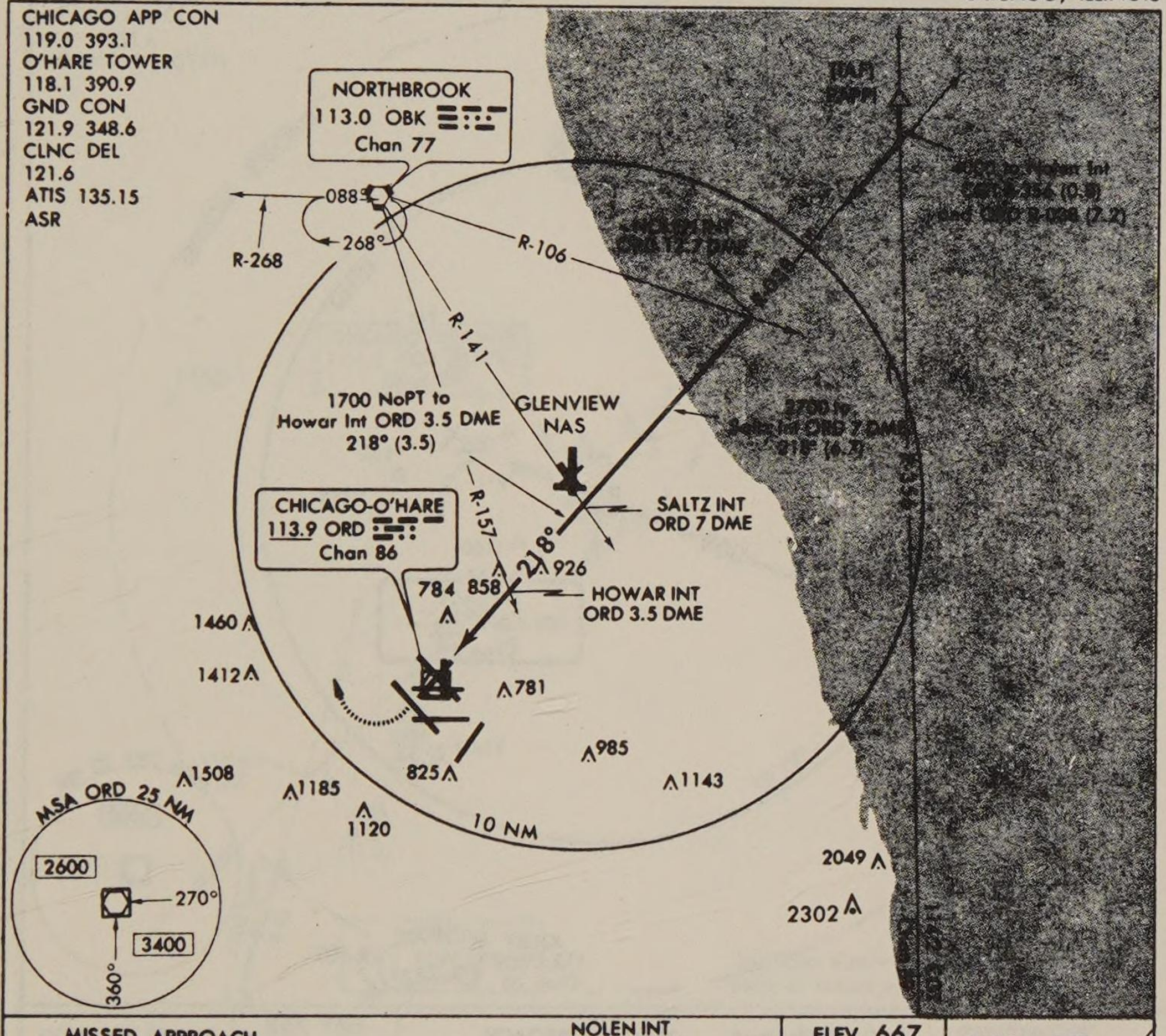
CHICAGO, ILLINOIS
CHICAGO MIDWAY(MDW)

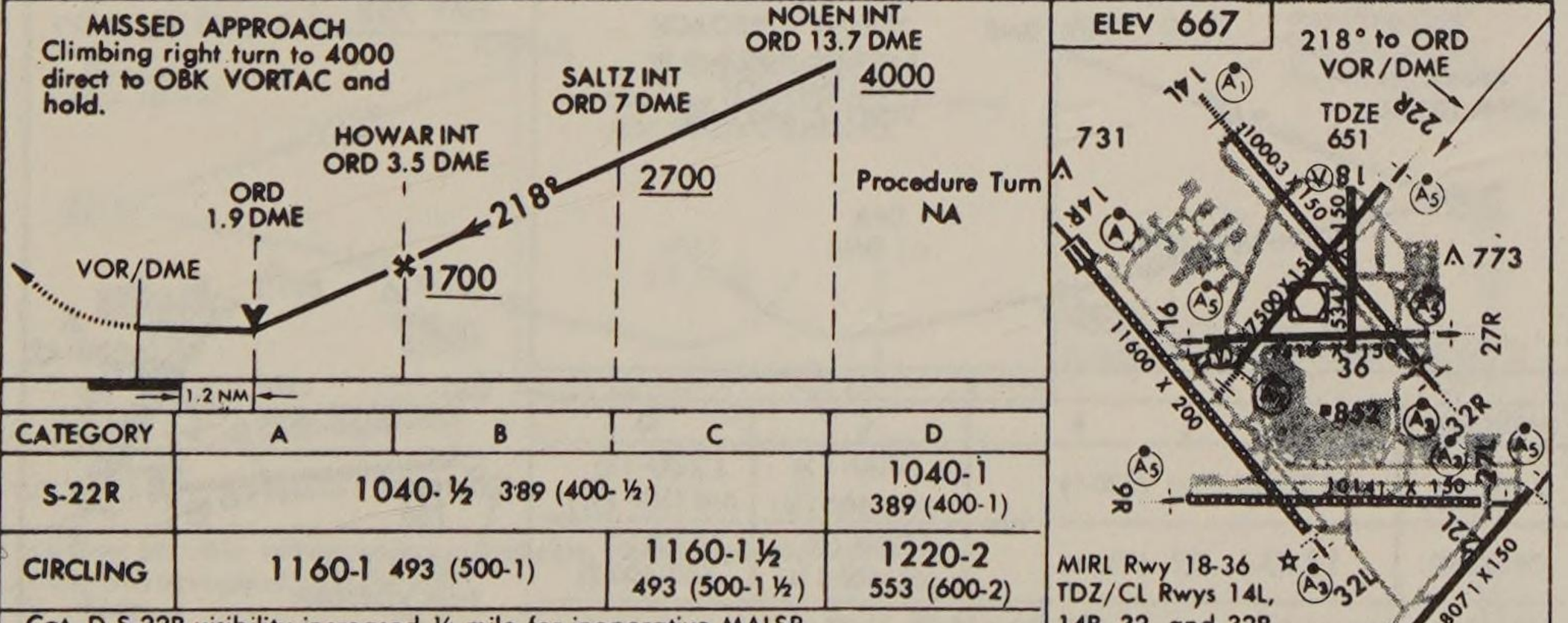
Not for use in Navigation

Amdt 7

VOR RWY 22R

CHICAGO-O'HARE INTERNATIONAL (ORD)
CHICAGO, ILLINOIS





CATEGORY	A	B	C	D
S-22R	1040-½ 389 (400-½)			1040-1 389 (400-1)
CIRCLING	1160-1 493 (500-1)		1160-1½ 493 (500-1½)	1220-2 553 (600-2)

Cat. D S-22R visibility increased ¼ mile for inoperative MALSR.

▽

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 22R

41°59'N – 87°54'W

CHICAGO, ILLINOIS
CHICAGO-O'HARE INTERNATIONAL (ORD)

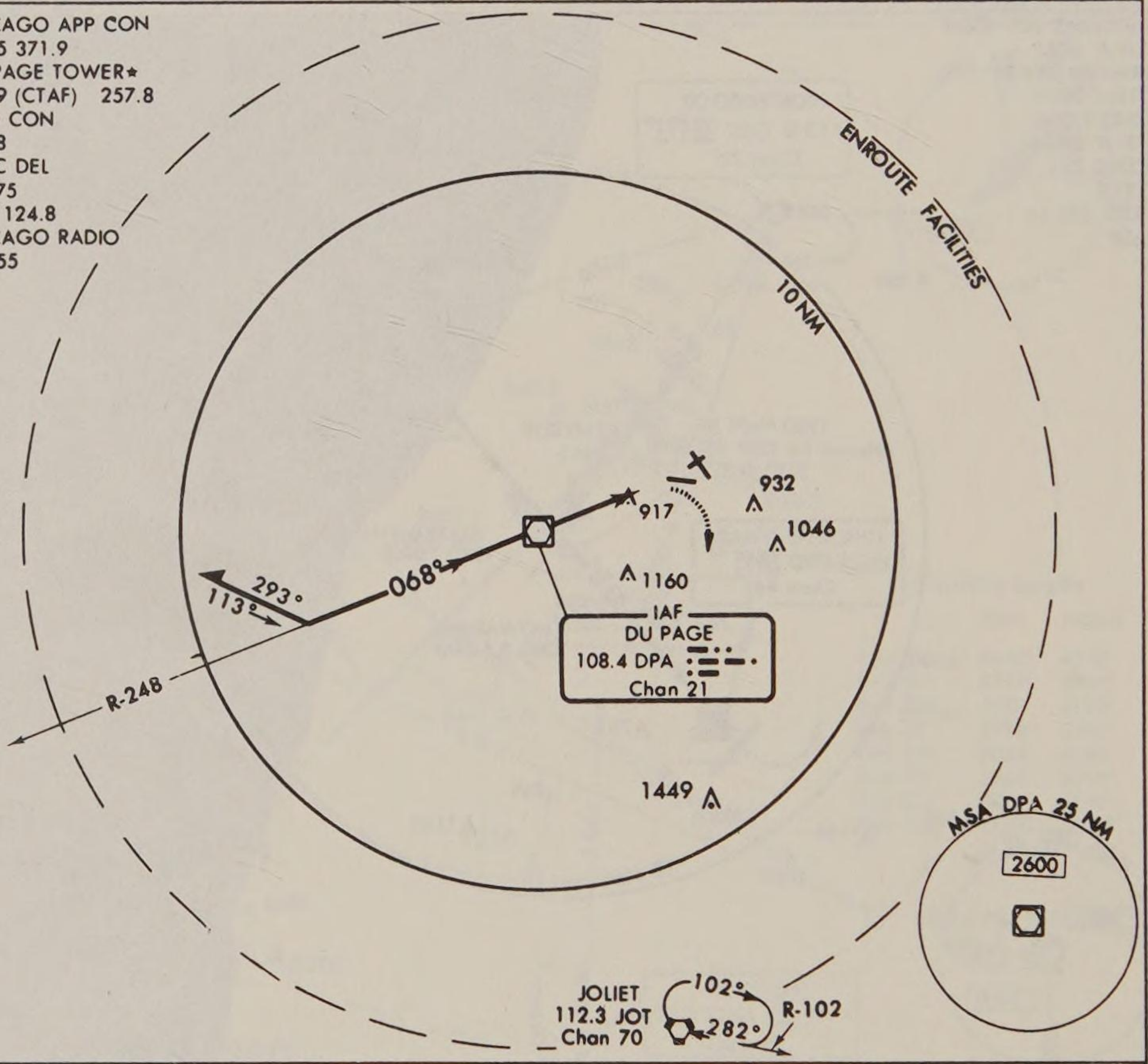
Not for use in Navigation

Amdt 10

VOR RWY 10

CHICAGO/DU PAGE (DPA)
CHICAGO (WEST CHICAGO), ILLINOIS

CHICAGO APP CON
133.5 371.9
DU PAGE TOWER★
120.9 (CTAF) 257.8
GND CON
121.8
CLNC DEL
119.75
ATIS 124.8
CHICAGO RADIO
122.55



VOR/DME

Remain within 10 NM

3000

248°

068°

2200

4.1

0.2

DPA
4.1 DME

MISSED APPROACH
Climbing right turn to 2500 direct JOT VORTAC and hold.

ELEV 758

Rwy 33 ldg 3211'

MIRL Rwys 10-28, and 15-33
REIL Rwy 10, 15, 28 and 33

CATEGORY	A	B	C	D
S-10	1200-1 444 (500-1)		1200-1¼ 444 (500-1¼)	1200-1½ 444 (500-1½)
CIRCLING	1240-1 482 (500-1)		1240-1½ 482 (500-1½)	1320-2 562 (600-2)

When control tower closed activate MIRL Rwys 10-28, 15-33, REIL Rwys 10, 15, 28, and 33 – CTAF.

FAF to MAP 4.1 NM					
Knots	60	90	120	150	180
Min:Sec	4:06	2:44	2:03	1:38	1:22

VOR RWY 10

41°55'N-88°15'W

CHICAGO (WEST CHICAGO), ILLINOIS
CHICAGO/DU PAGE (DPA)

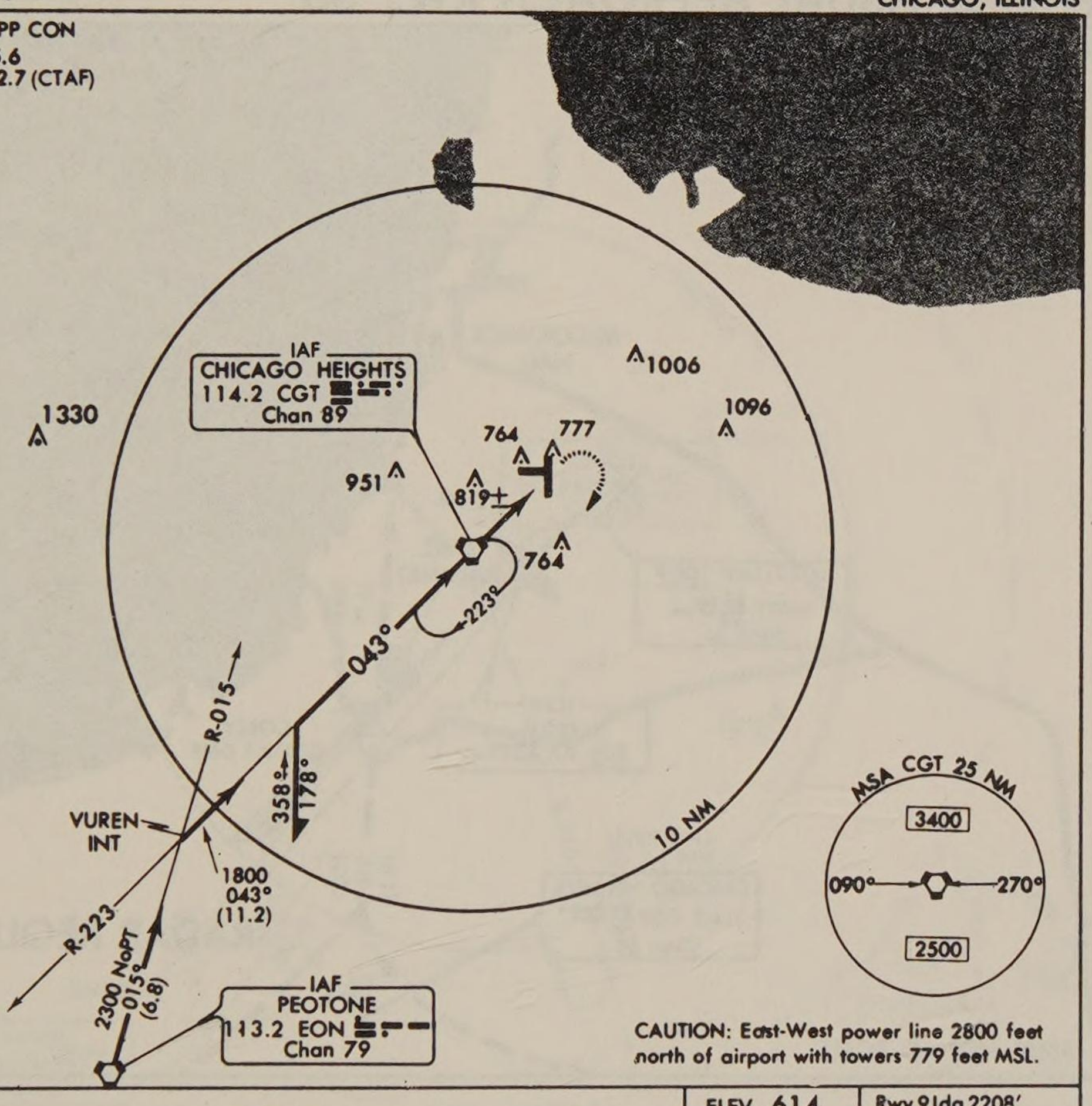
Not for use in Navigation

Amdt 4

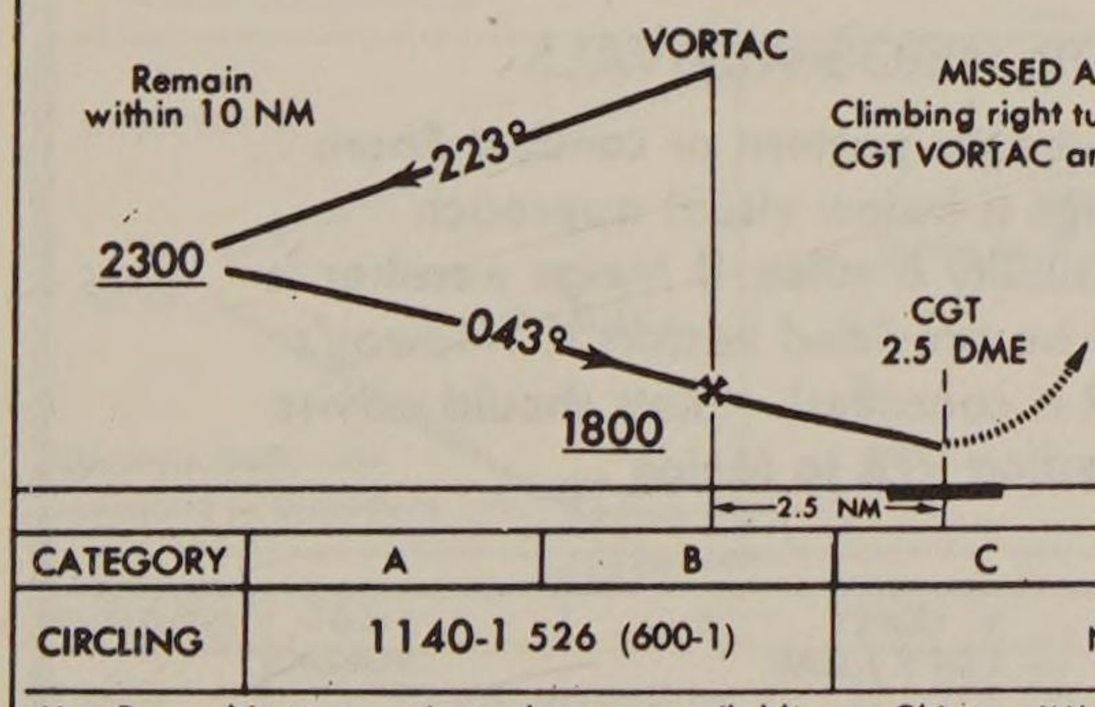
VOR-A

CHICAGO/LANSING MUNI (3HA)
CHICAGO, ILLINOIS

CHICAGO APP CON
133.1 285.6
UNICOM 122.7 (CTAF)



CAUTION: East-West power line 2800 feet north of airport with towers 779 feet MSL.



MISSED APPROACH
Climbing right turn to 2300 direct CGT VORTAC and hold.

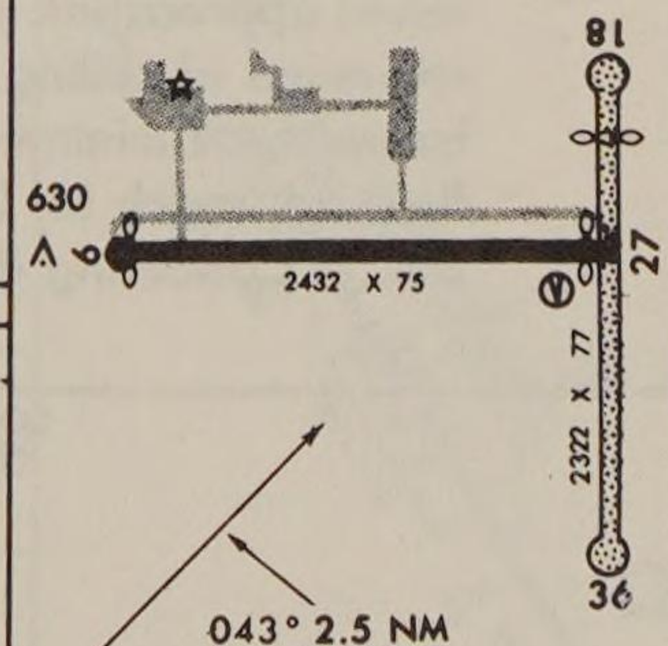
CATEGORY	A	B	C	D
CIRCLING	1140-1 526 (600-1)		NA	

Use Gary altimeter setting; when not available, use Chicago (Midway) altimeter setting and increase all MDAs 60 feet.

T
A NA

ELEV 614

Rwy 9 Idg 2208'
Rwy 27 Idg 2380'
Rwy 18 Idg 1972'



FAF to MAP 2.5 NM

Knots	60	90	120	150	180
Min: Sec	2:30	1:40	1:15	1:00	0:50

VOR-A

41°32'N – 87°32'W

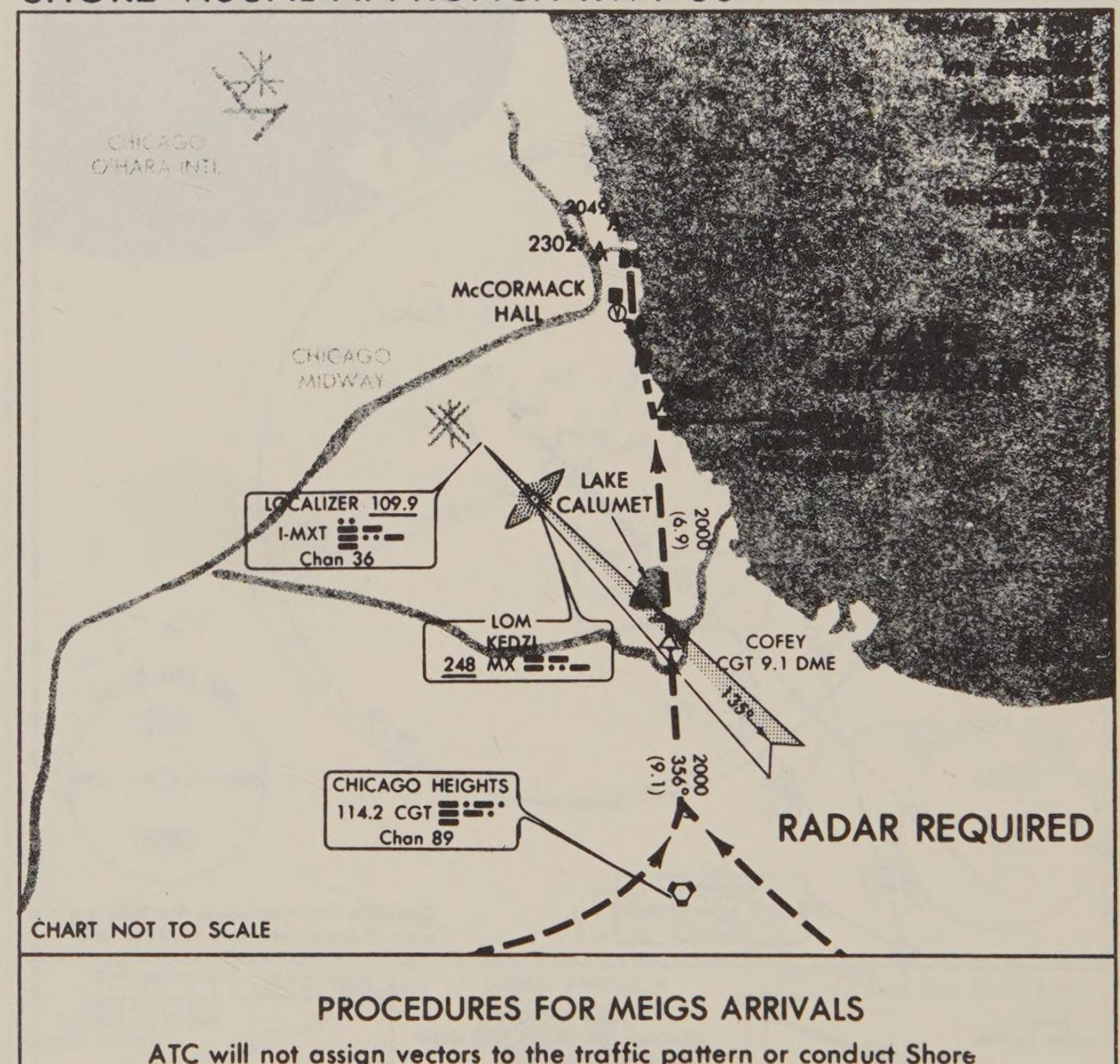
CHICAGO, ILLINOIS
CHICAGO/LANSING MUNI (3HA)

Not for use in Navigation

Amdt 2

CHICAGO/MERRILL C MEIGS (CGX)
CHICAGO ILLINOIS

SHORE VISUAL APPROACH RWY 36



PROCEDURES FOR MEIGS ARRIVALS

ATC will not assign vectors to the traffic pattern or conduct Shore visual approaches, whenever Meigs is below visual approach minimums of ceiling 1900 feet, visibility 6 miles. If Meigs weather is below these minimums, pilots will be provided vectors to Midway's final approach for landing. If IFR is cancelled - Pilots should advise ATC - "Cancelling IFR and proceeding VFR to Meigs".

SHORE VISUAL APPROACH RWY 36

CHICAGO, ILLINOIS

41°52'N - 87°36'W

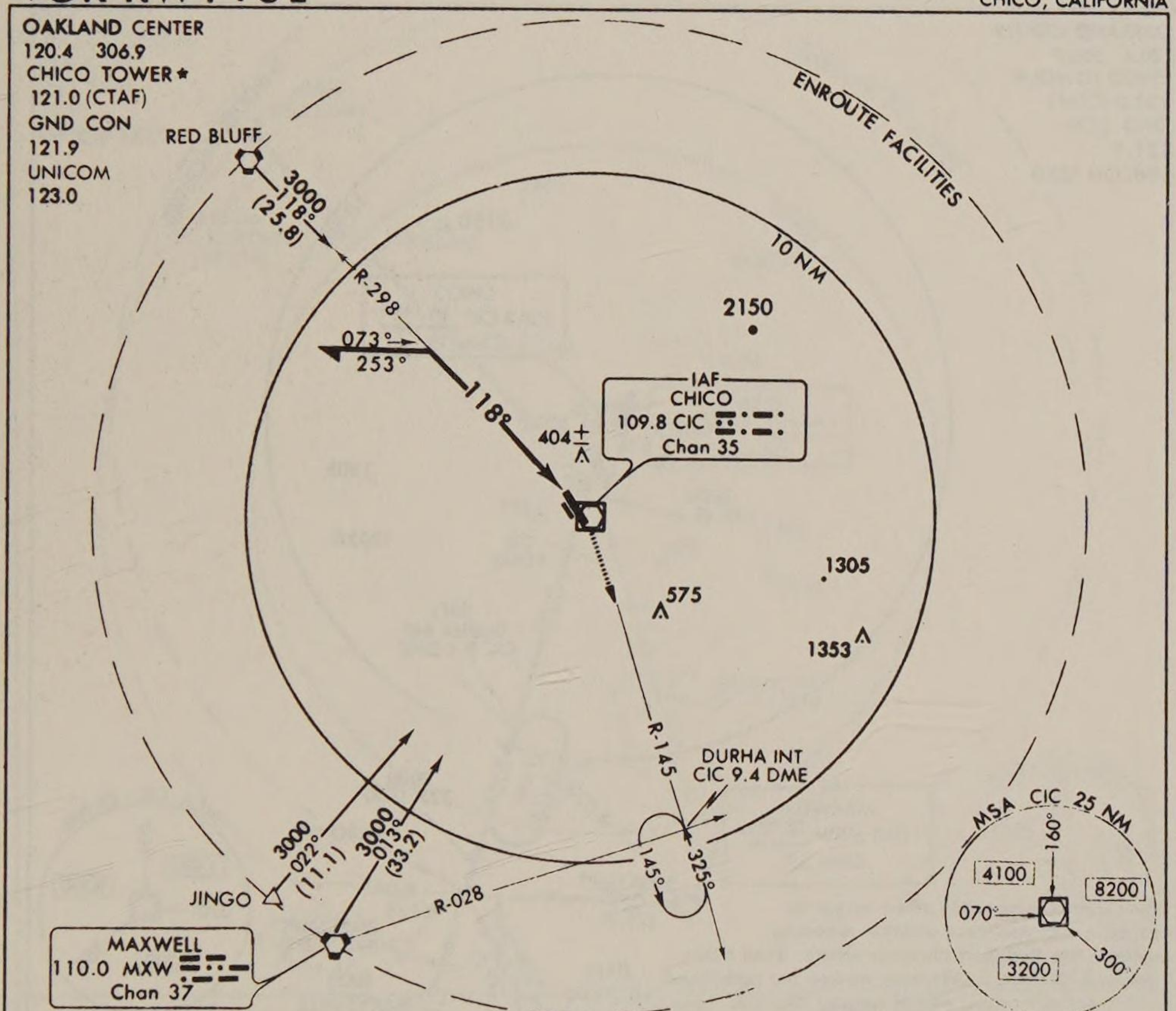
CHICAGO/MERRILL C MEIGS (CGX)

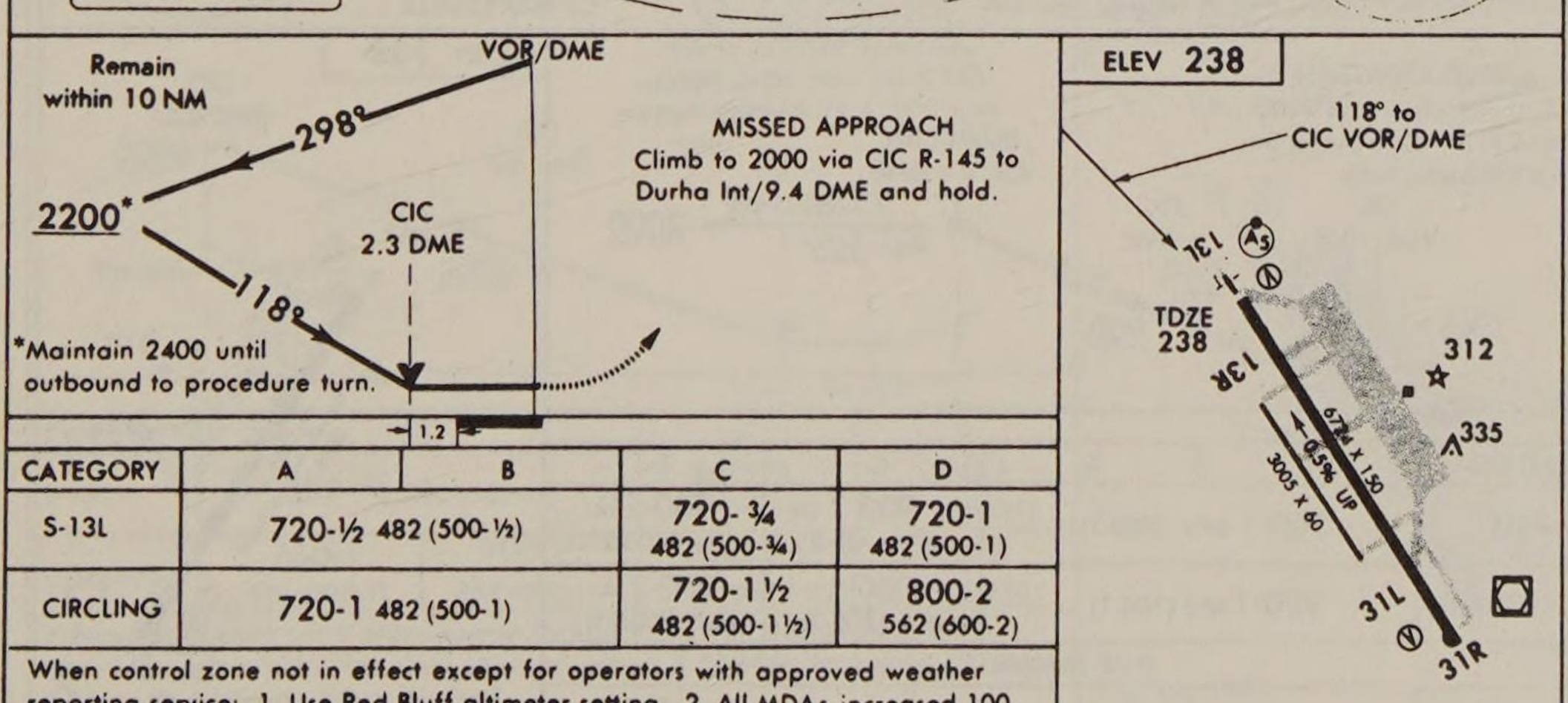
Not for use in Navigation

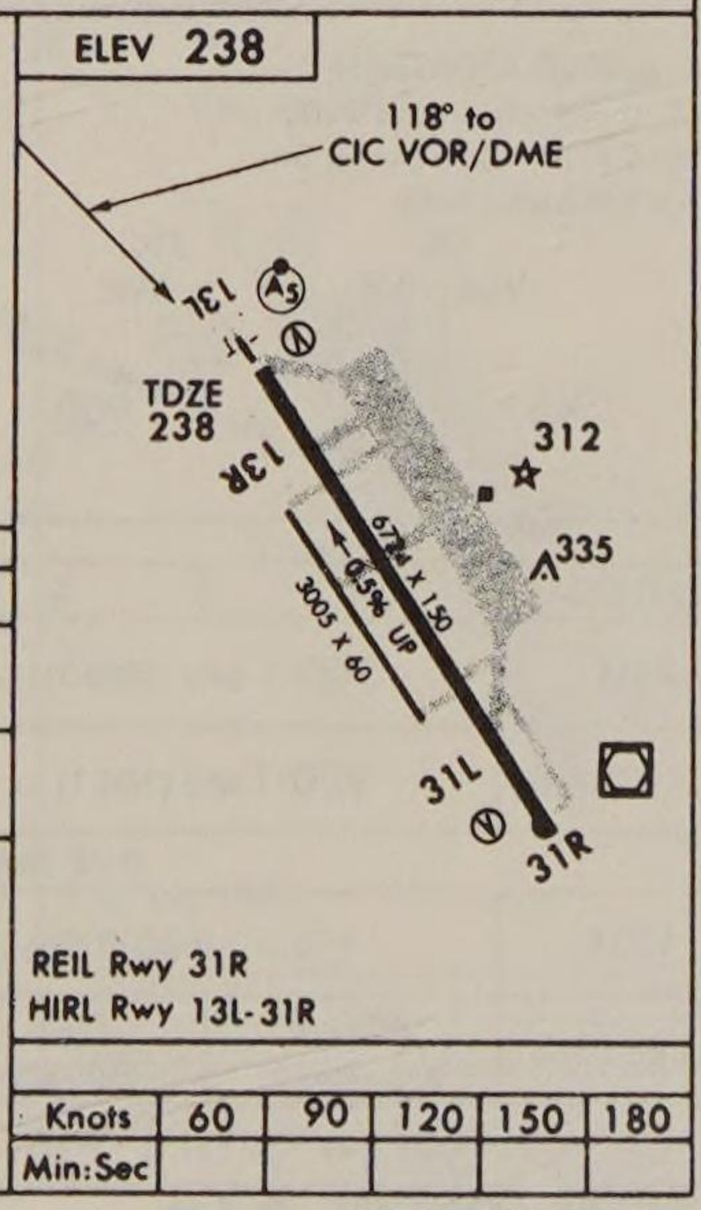
Amdt 6

VOR RWY13L

CHICO MUNI (CIC)
CHICO, CALIFORNIA







CATEGORY	A	B	C	D
S-13L	720-½ 482 (500-½)		720-¾ 482 (500-¾)	720-1 482 (500-1)
CIRCLING	720-1 482 (500-1)		720-1½ 482 (500-1½)	800-2 562 (600-2)

When control zone not in effect except for operators with approved weather reporting service: 1. Use Red Bluff altimeter setting. 2. All MDAs increased 100 feet. 3. Alternate minimums not authorized.
Circling not authorized east of Rwy 13L/31R.
ACTIVATE MALSR Rwy 13L-121.0.

Knots	60	90	120	150	180
Min:Sec					

VOR RWY13L

39°48'N-121°51'W

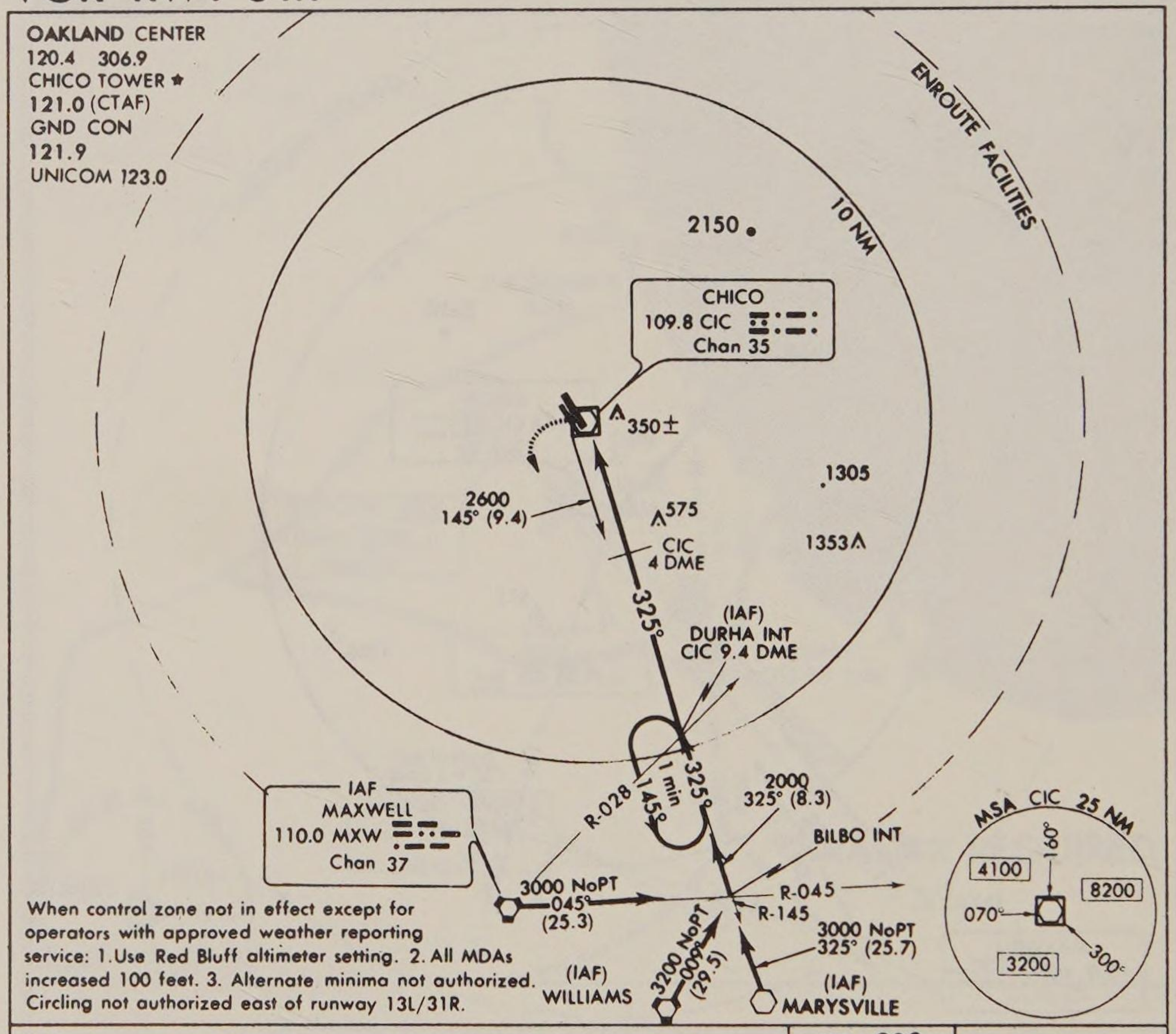
CHICO, CALIFORNIA
CHICO MUNI (CIC)

Not for use in Navigation

Amdt 5

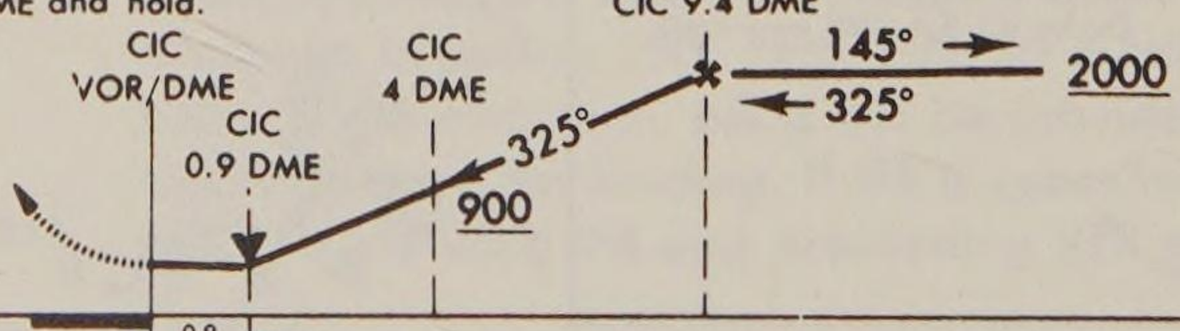
VOR RWY 31R

CHICO MUNI (CIC)
CHICO, CALIFORNIA



When control zone not in effect except for operators with approved weather reporting service: 1. Use Red Bluff altimeter setting. 2. All MDAs increased 100 feet. 3. Alternate minima not authorized. Circling not authorized east of runway 13L/31R.

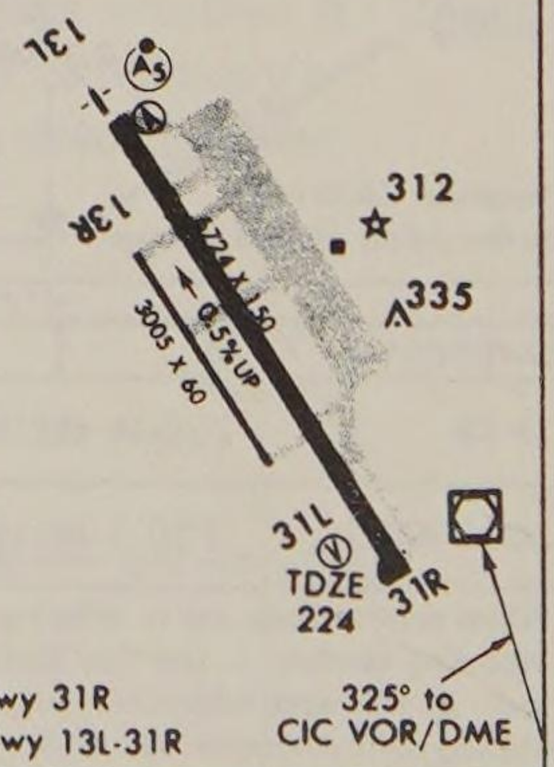
MISSED APPROACH
Climbing left turn to 2000 via CIC R-145 to Durha Int/ 9.4 DME and hold.



CATEGORY	A	B	C	D
S-31R	900-1 676 (700-1)		900-2 676 (700-2)	900-2 ¼ 676 (700-2 ¼)
CIRCLING	900-1 662 (700-1)		900-2 662 (700-2)	900-2 ¼ 662 (700-2 ¼)
DME MINIMA				
S-31R	600-1 376 (400-1)			600-1 ¼ 376 (400-1 ¼)
CIRCLING	600-1 362 (400-1)	700-1 462 (500-1)	700-1 ½ 462 (500-1 ½)	800-2 562 (600-2)

ACTIVATE MALSR Rwy 13L-121.0.

ELEV 238



REIL Rwy 31R
HIRL Rwy 13L-31R

325° to CIC VOR/DME

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 31R

39°48'N – 121°51'W

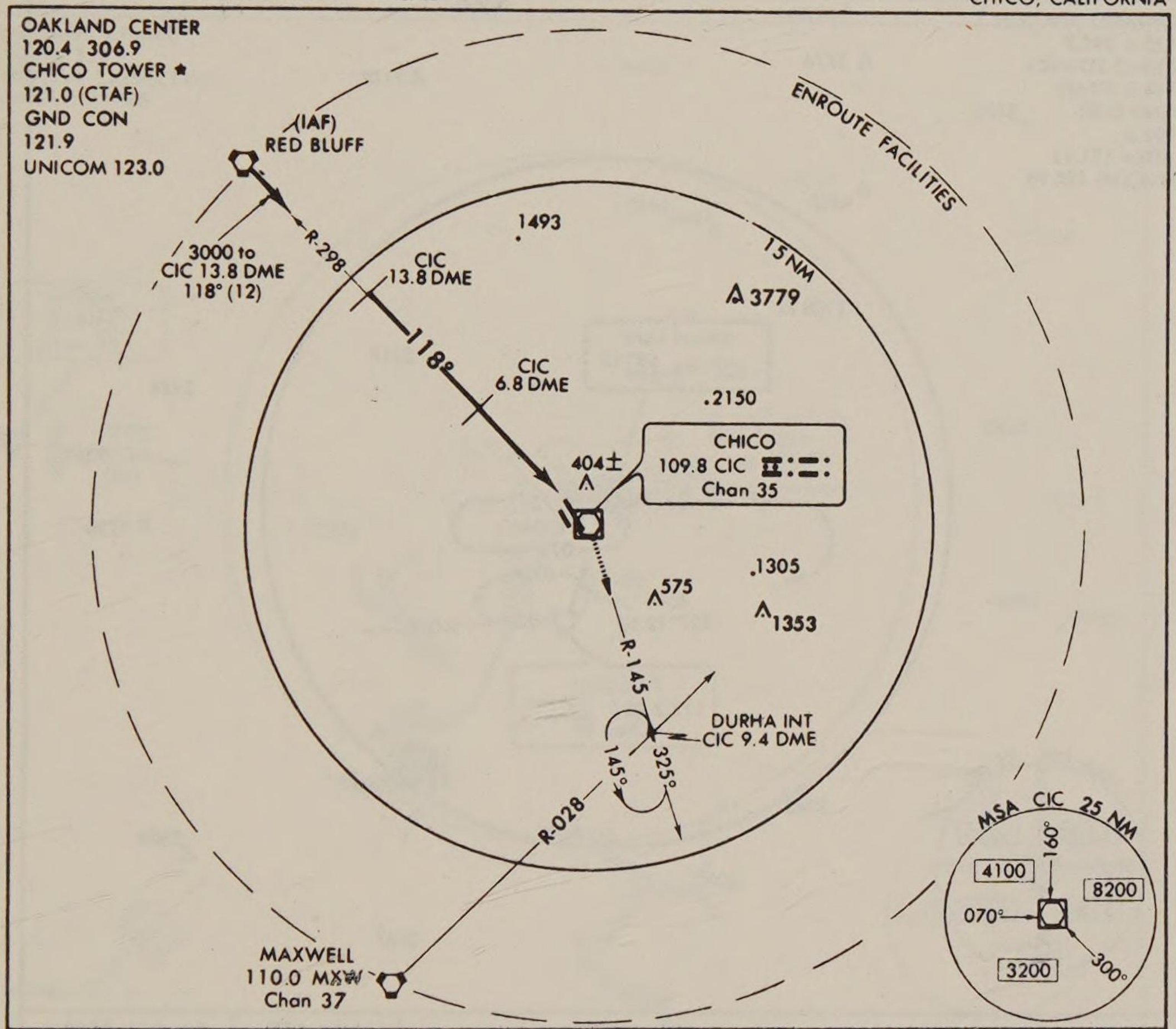
CHICO, CALIFORNIA
CHICO MUNI (CIC)

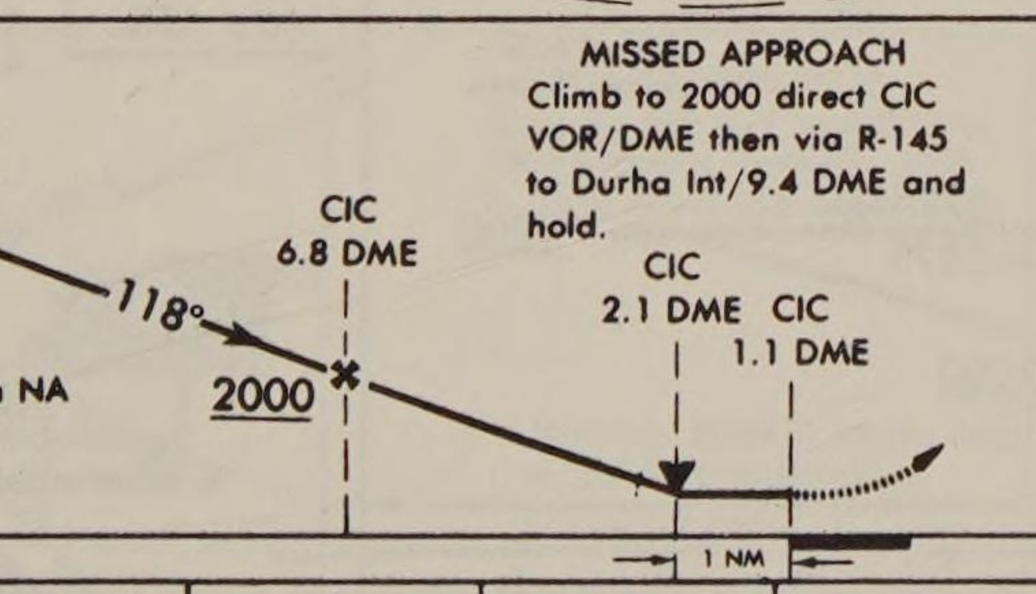
Not for use in Navigation

Amdt 3

VOR/DME RWY 13L

CHICO MUNI (CIC)
CHICO, CALIFORNIA

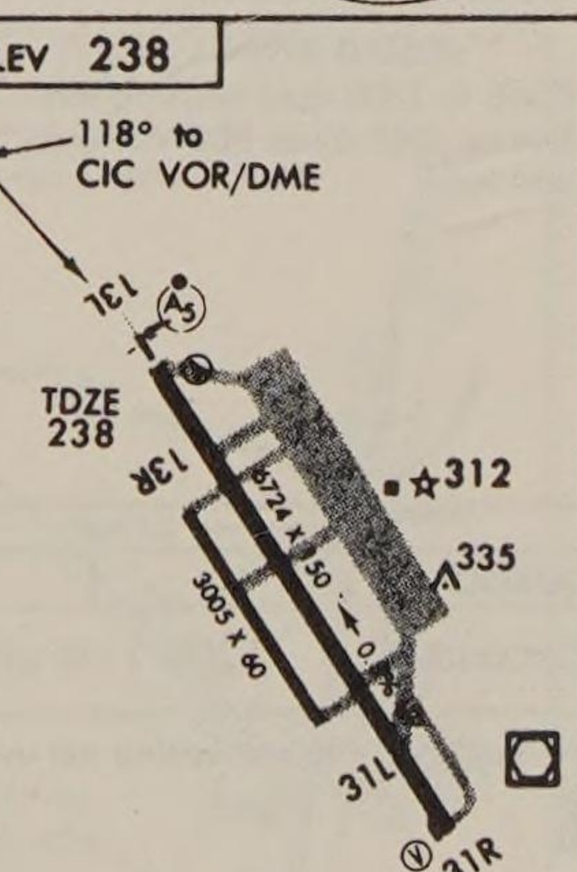




CATEGORY	A	B	C	D
S-13L	660 - ½ 422 (500-½)		660-¾ 422 (500-¾)	660-1 422 (500-1)
CIRCLING	660-1 422 (500-1)	700-1 462 (500-1)	700-1½ 462 (500-1½)	800-2 562 (600-2)

When control zone not in effect except for operators with approved weather reporting service: 1.Use Red Bluff altimeter setting. 2.All MDAs increased 120 feet. 3.Alternate minimums not authorized.
Circling not authorized east of runway 13L/31R.
ACTIVATE MALSR Rwy 13L-121.0.
Cat. D increase visibility ¼ mile for inoperative MALSR Rwy 13L.

ELEV 238



REIL Rwy 31R
HIRL Rwy 13L-31R

Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 13L

39°48'N – 121°51'W

CHICO, CALIFORNIA
CHICO MUNI (CIC)

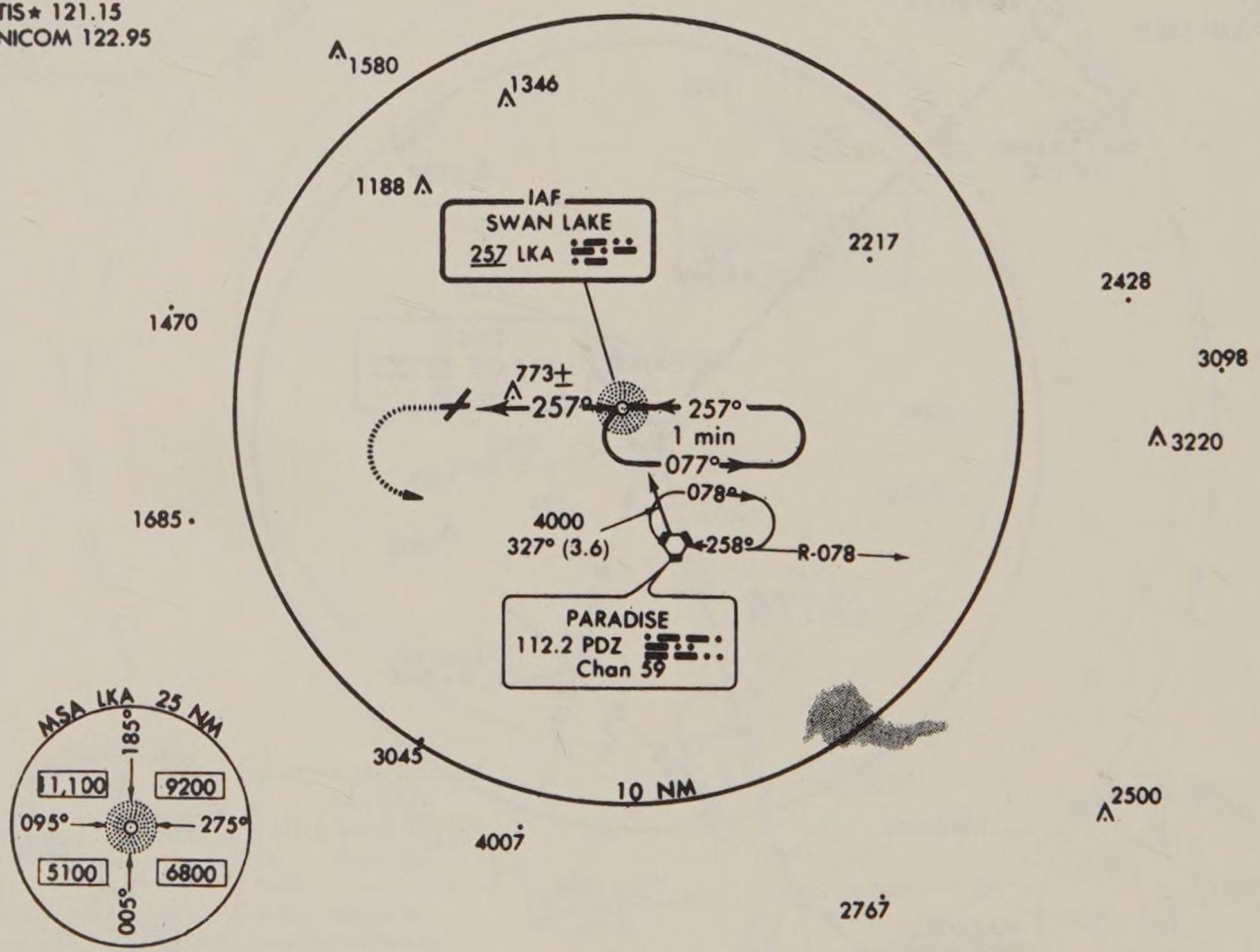
Not for use in Navigation

Amdt 1

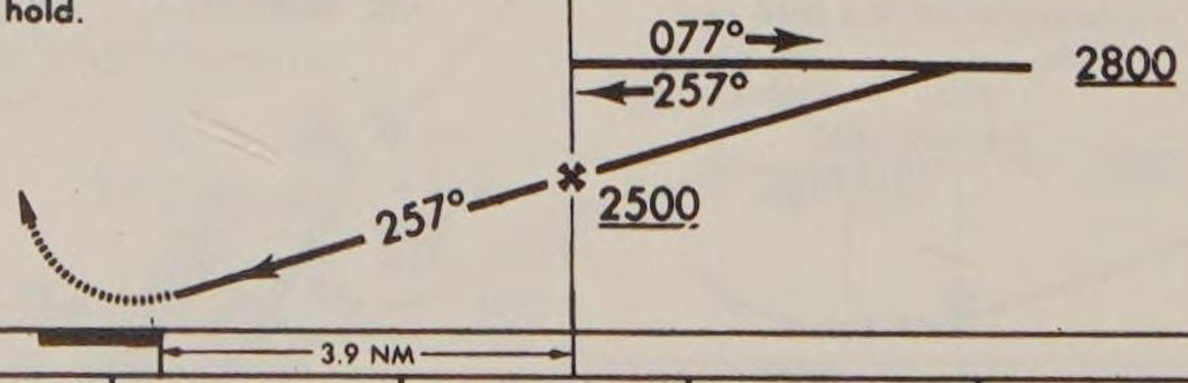
NDB-C

CHINO (CNO)
CHINO, CALIFORNIA

ONTARIO APP CON
135.4 295.7
CHINO TOWER★
118.5 (CTAF)
GND CON 121.6
ATIS★ 121.15
UNICOM 122.95



MISSED APPROACH
Climb to 1400 then climbing left turn to 4000 direct PDZ VORTAC and hold.

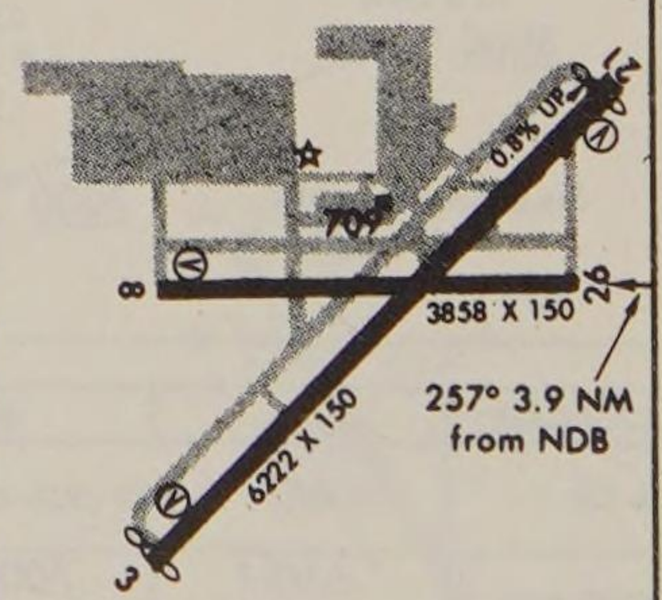


CATEGORY	A	B	C	D
CIRCLING	1200-1 550 (600-1)		1200-1½ 550 (600-1½)	1220-2 570 (600-2)

When Chino altimeter setting not available use Ontario altimeter setting.

ELEV 650

Rwy 3 ldg 5992′
Rwy 21 ldg 6112′



HIRL Rwy 8-26
MIRL Rwy 3-21
REIL Rwy 21

FAF to MAP 3.9 NM					
Knots	60	90	120	150	180
Min:Sec	3:54	2:36	1:57	1:34	1:18

NDB-C

33°58′N-117°38′W

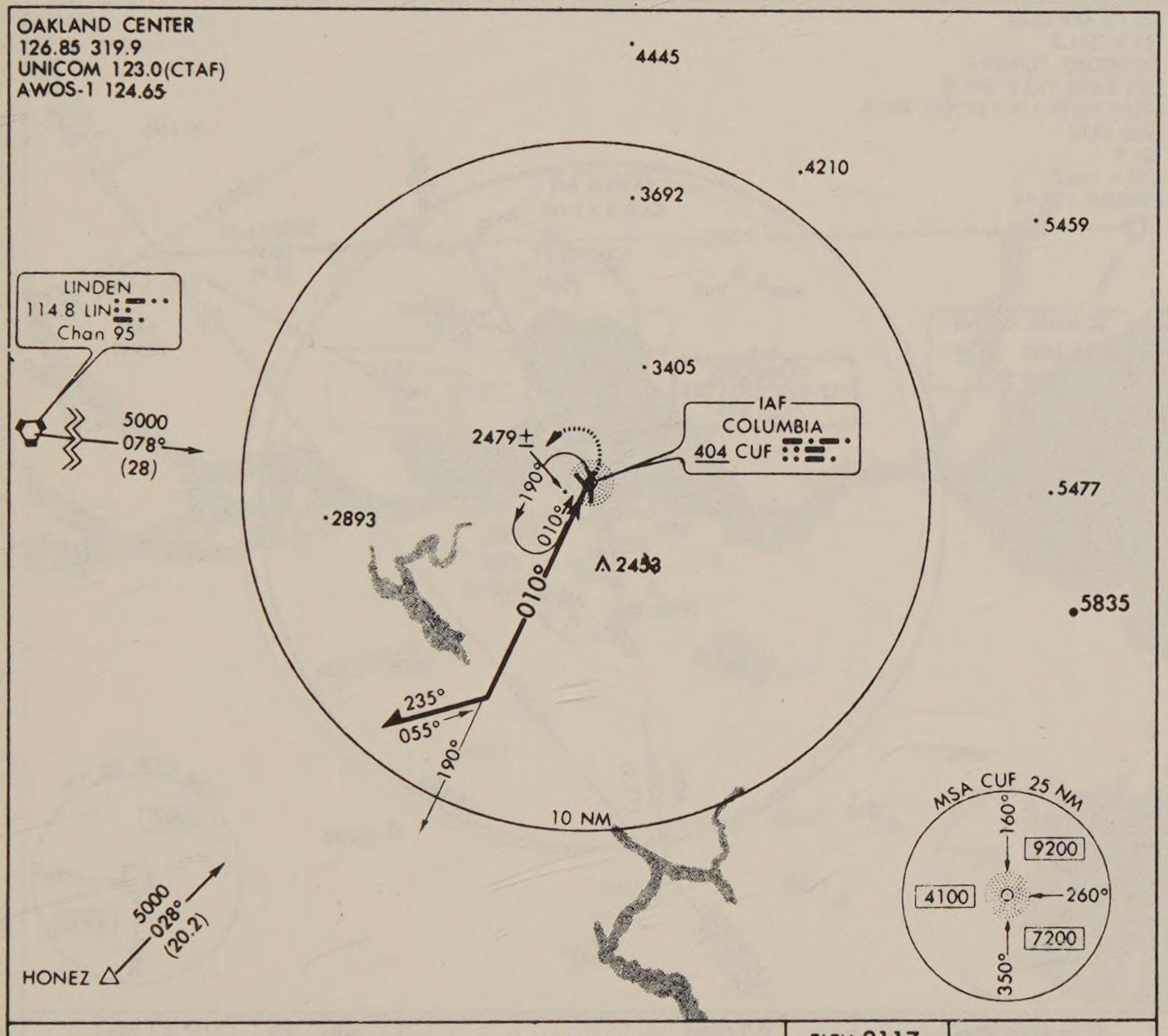
CHINO, CALIFORNIA
CHINO (CNO)

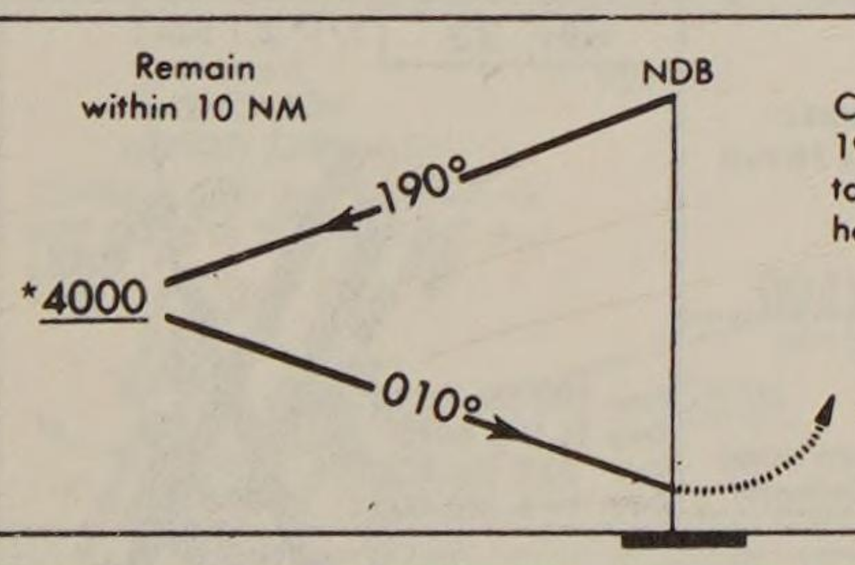
Not for use in Navigation

Orig
NDB-A

COLUMBIA (022)
COLUMBIA, CALIFORNIA

OAKLAND CENTER
126.85 319.9
UNICOM 123.0(CTAF)
AWOS-1 124.65



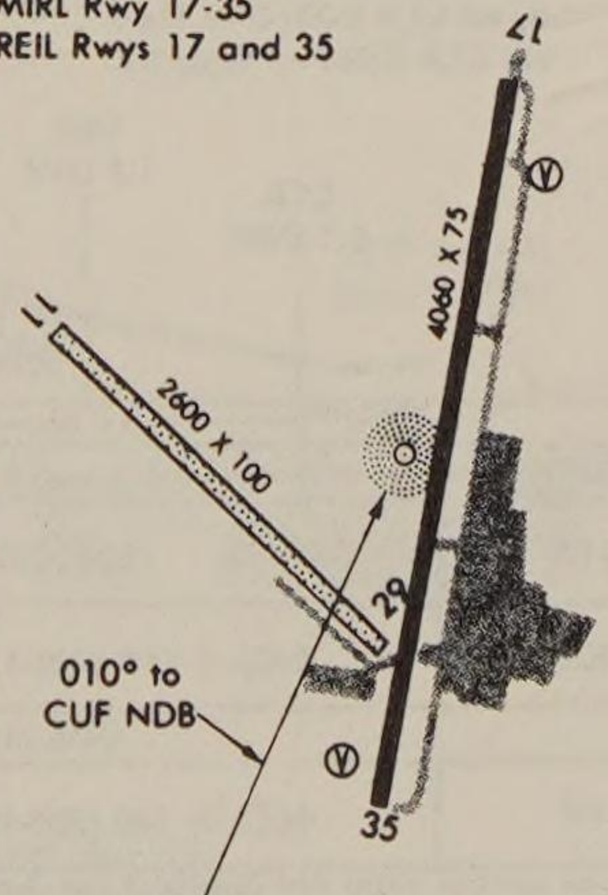


MISSED APPROACH
Climbing left turn to 4000 via 190° heading, continue climb to 5000 direct CUF NDB and hold.

*Maintain 5000 or above until established outbound to procedure turn.

ELEV 2117

MIRL Rwy 17-35
REIL Rwys 17 and 35



CATEGORY	A	B	C	D
CIRCLING	2840-1 723 (800-1)		2840-2. 723 (800-2)	NA

Obtain local altimeter setting on AWOS; when not available, procedure not authorized.
Circling not authorized east of Rwy 17-35.

▼
▲ NA

Knots	60	90	120	150	180
Min:Sec					

NDB-A

38°02'N-120°25'W

COLUMBIA, CALIFORNIA
COLUMBIA (022)

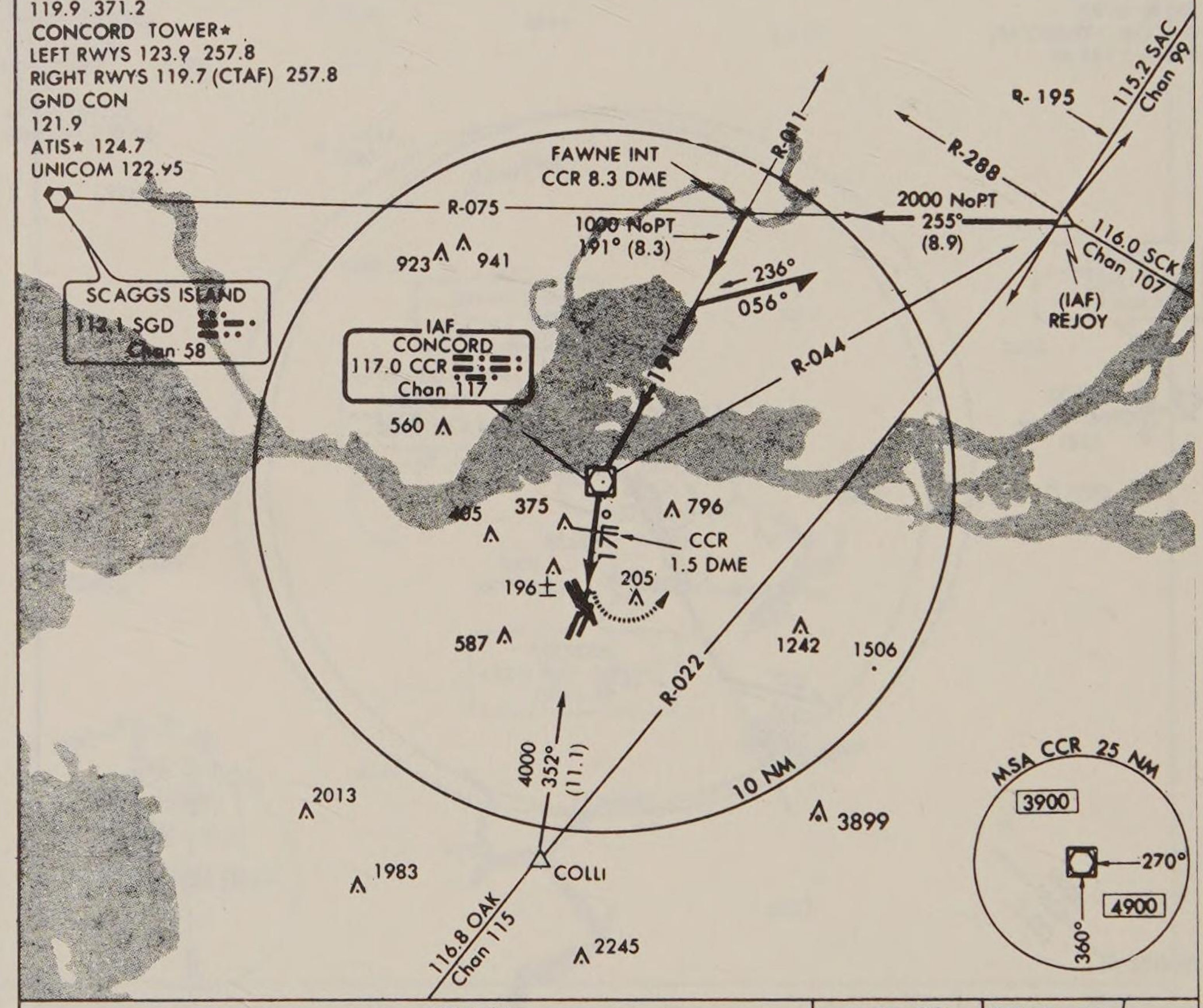
Not for use in Navigation

Amdt 12

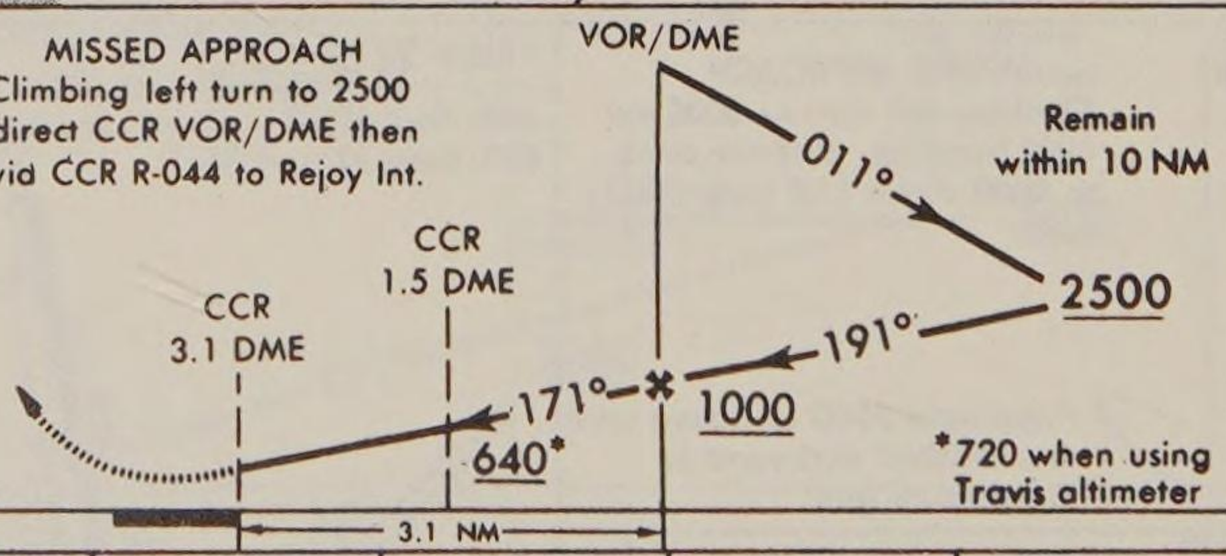
VOR RWY 19R

CONCORD/BUCHANAN FLD (CCR)
CONCORD, CALIFORNIA

TRAVIS APP CON
119.9 .371.2
CONCORD TOWER*
LEFT RWYS 123.9 257.8
RIGHT RWYS 119.7 (CTAF) 257.8
GND CON
121.9
ATIS* 124.7
UNICOM 122.95



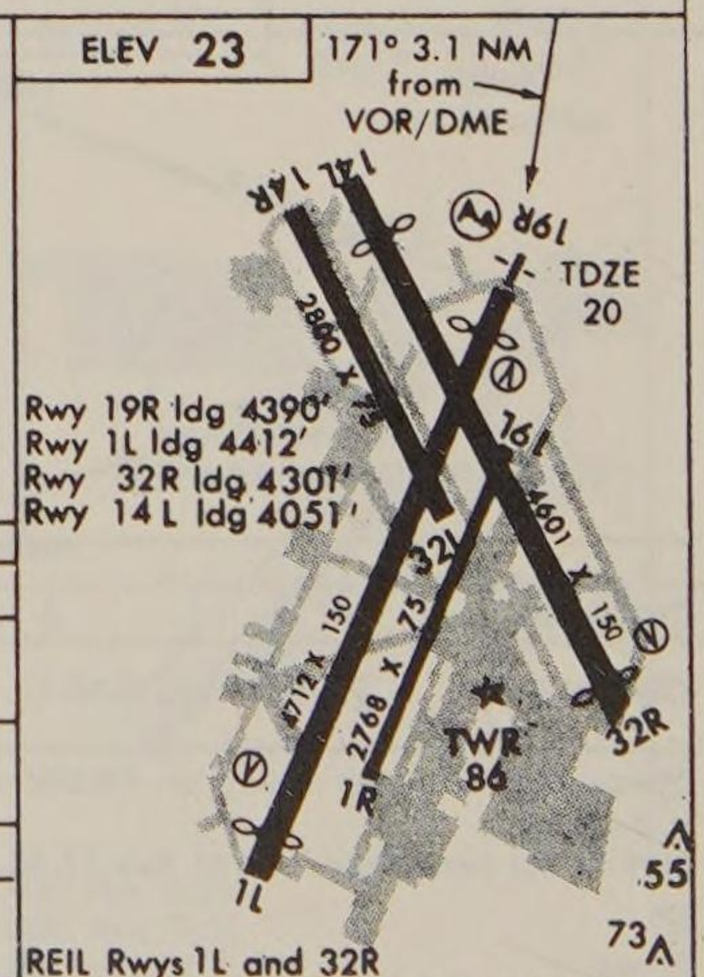
MISSED APPROACH
Climbing left turn to 2500 direct CCR VOR/DME then vid CCR R-044 to Rejoy Int.



CATEGORY	A	B	C	D
S-19R	640-¾	620 (700-¾)	640-1¾ 620 (700-1¾)	NA
CIRCLING	640-1	617 (700-1)	680-1¾ 657 (700-1¾)	NA
DME MINIMUMS				
S-19R	460-¾	440 (500-¾)	460-1¼ 440 (500-1¼)	NA

When control zone not in effect use Travis AFB altimeter setting and increase all MDAs 80 feet.
Circling NA west of Rwys 1L and 14R.
ACTIVATE MALS Rwy 19R-CTAF.
Inoperative table does not apply to Cat. C TA

ELEV 23



Rwy 19R ldg 4390'
Rwy 1L ldg 4412'
Rwy 32R ldg 4301'
Rwy 14L ldg 4051'

REIL Rwys 1L and 32R
MIRL Rwys 1L-19R, 1R-19L and 14L-32R

FAF to MAP 3.1 NM

Knots	60	90	120	150	180
Min:Sec	3:06	2:04	1:33	1:14	1:02

VOR RWY 19R

37°59'N-122°03'W

CONCORD, CALIFORNIA
CONCORD/BUCHANAN FLD (CCR)

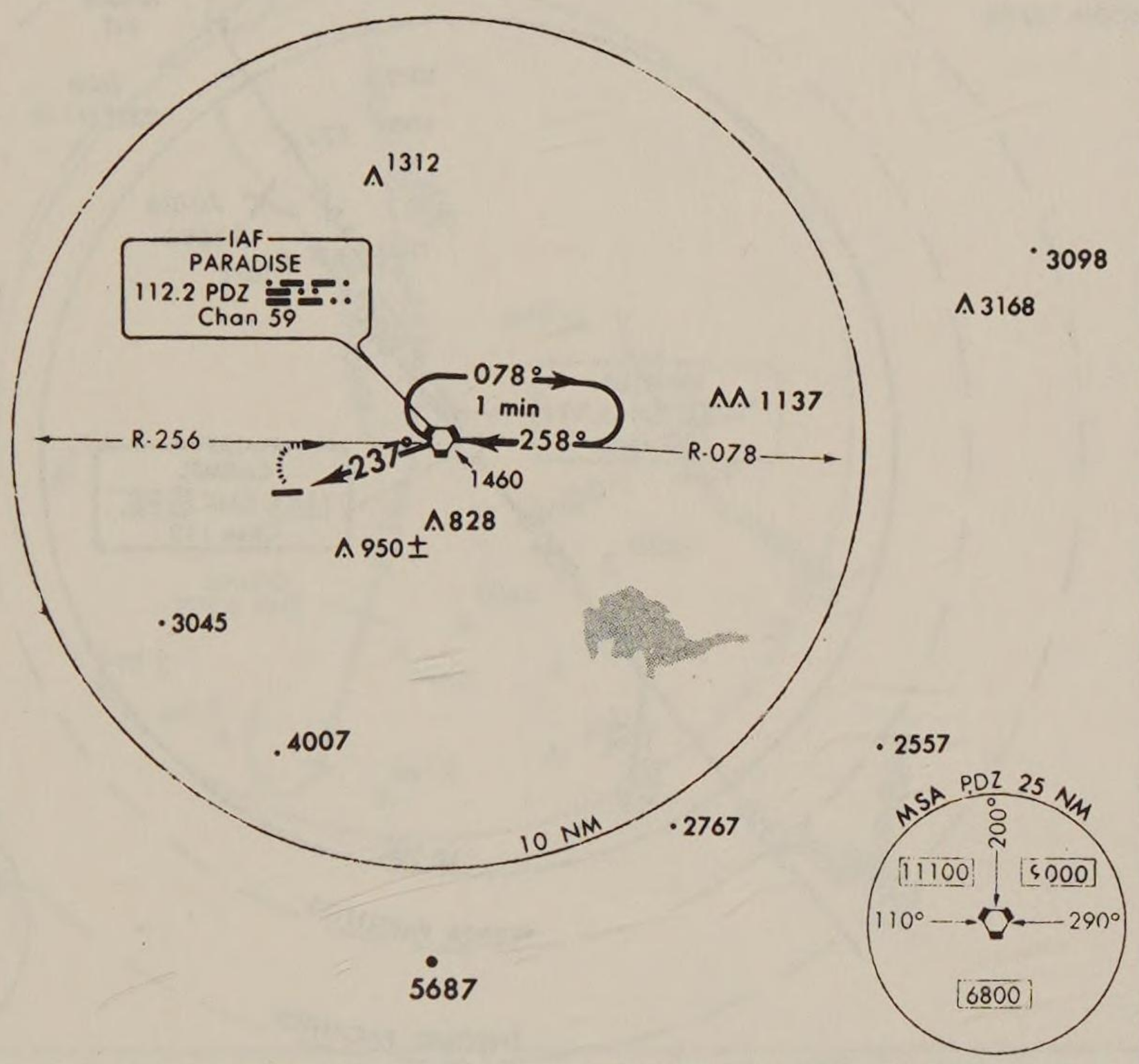
Not for use in Navigation

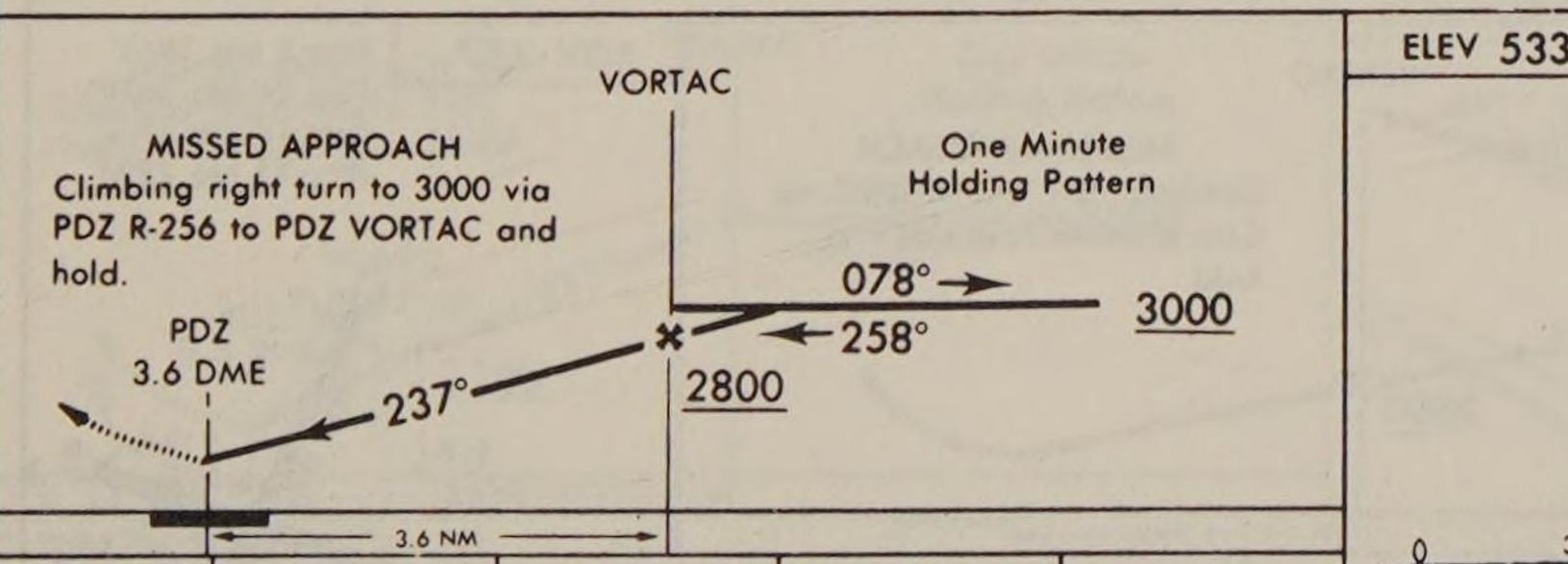
Amdt 2

VOR-A

CORONA MUNI (L66)
CORONA , CALIFORNIA

ONTARIO APP CON
135.4 295.7
UNICOM 122.8 (CTAF)





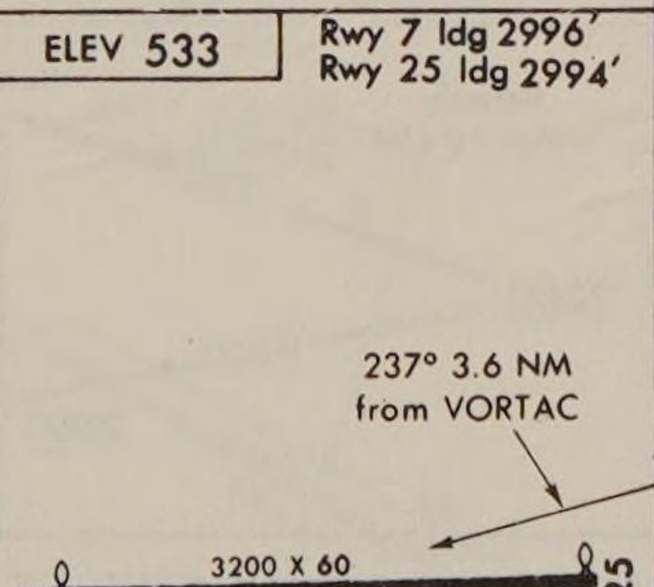
CATEGORY	A	B	C	D
CIRCLING	1360-1 827 (900-1)	1360-1¼ 827 (900-1¼)	NA	NA

Use Ontario, CA altimeter setting.

TA NA

ELEV 533

Rwy 7 ldg 2996'
Rwy 25 ldg 2994'



REIL Rwy 25
MIRL Rwy 7-25

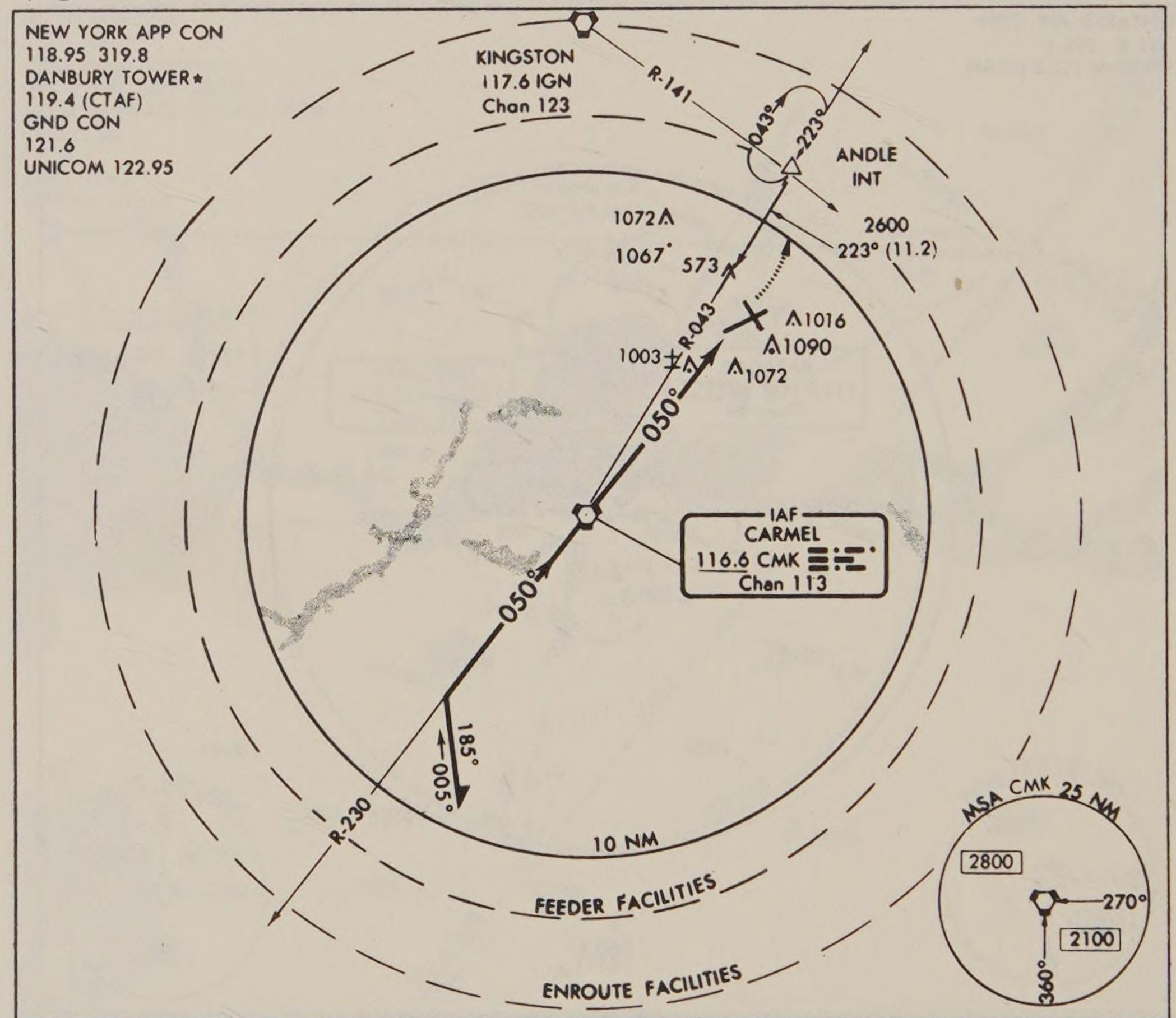
FAF to MAP 3.6 NM					
Knots	60	90	120	150	180
Min:Sec	3:36	2:24	1:48	1:26	1:12

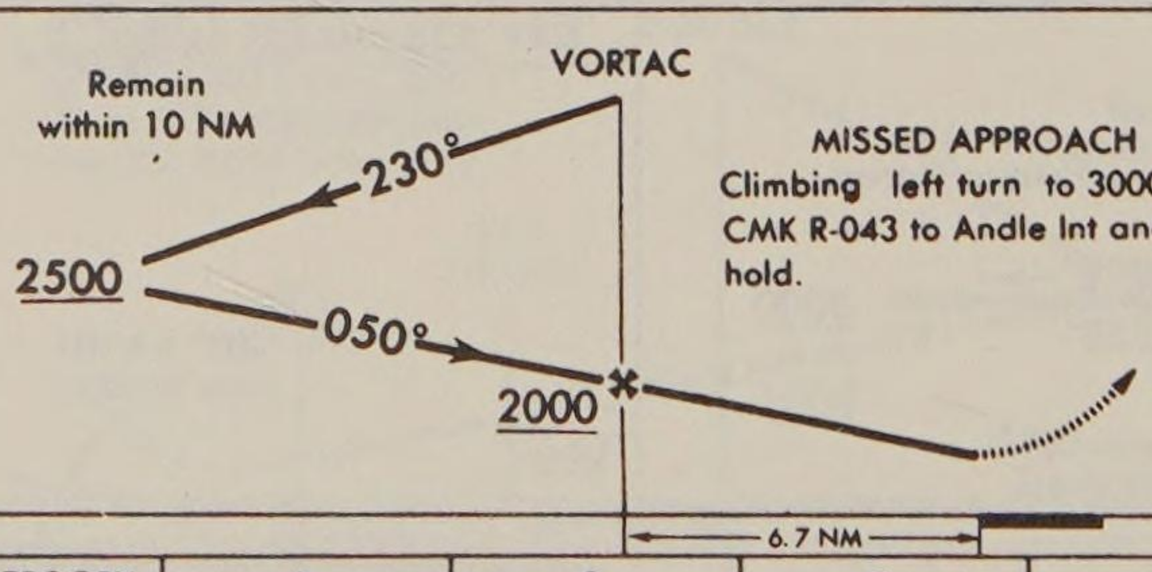
Not for use in Navigation

Amdt 5

VOR-A

DANBURY MUNI (DXR)
DANBURY, CONNECTICUT

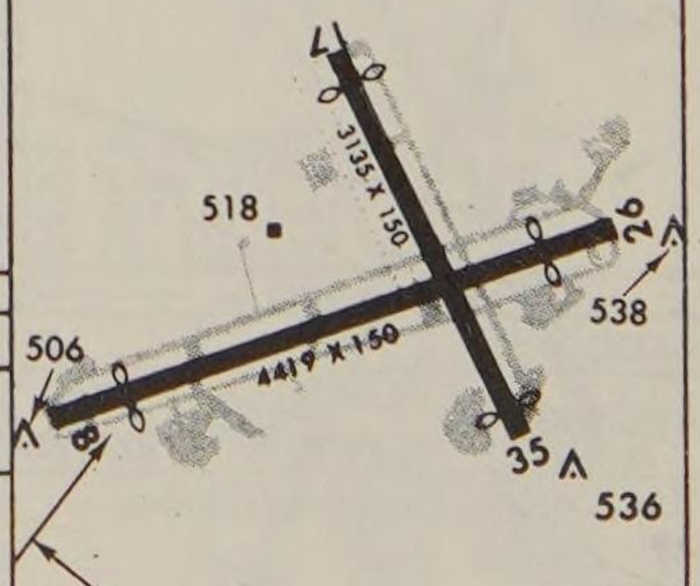




MISSED APPROACH
Climbing left turn to 3000 via CMK R-043 to Andle Int and hold.

ELEV 457

Rwy 8 ldg 3841′
Rwy 26 ldg 3679′
Rwy 17 ldg 2902′
Rwy 35 ldg 2894′



CATEGORY	A	B	C	D
CIRCLING*	1400-1¼ 943 (1000-1¼)		1400-2¾ 943 (1000-2¾)	1400-3 943 (1000-3)

When control tower closed, use White Plains altimeter setting and increase all MDAs to 1960 and visibilities to 3 miles.
*Circling to Rwy 35 not authorized.
▽
△ NA

REIL Rwys 8 and 26
MIRL Rwy 8-26

FAF to MAP 6.7 NM					
Knots	60	90	120	150	180
Min:Sec	6:42	4:28	3:21	2:41	2:14

VOR-A

41°22′N–73°29′W

DANBURY, CONNECTICUT
DANBURY MUNI (DXR)

Not for use in Navigation

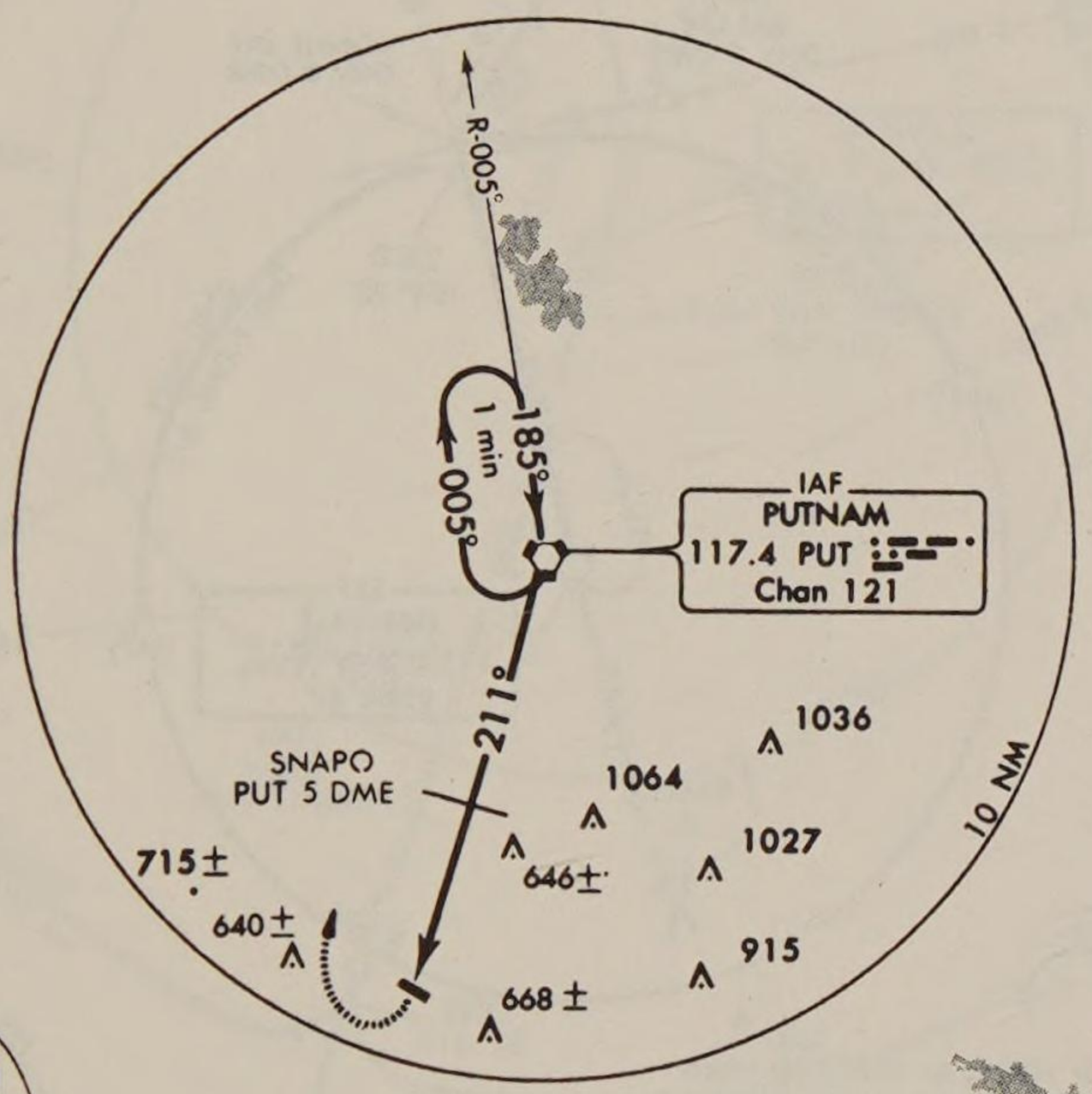
Amdt 2

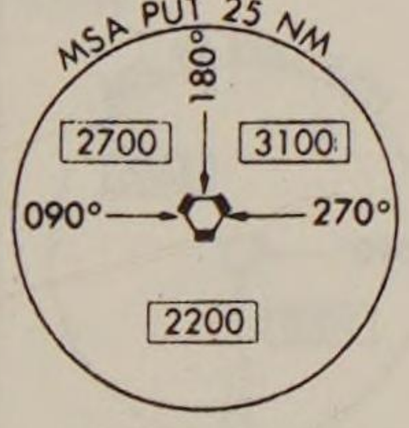
VOR-A

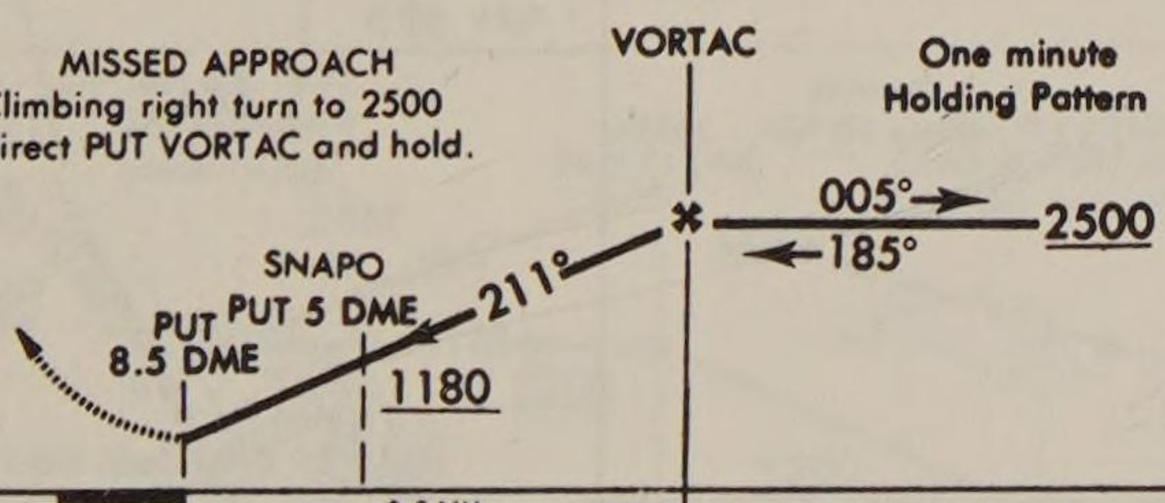
DANIELSON (5B3)
DANIELSON, CONNECTICUT

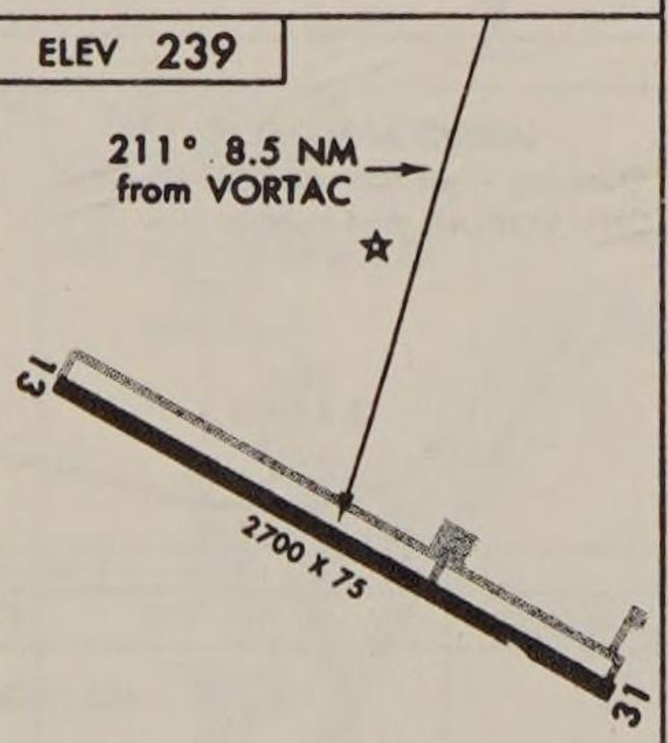
BRADLEY APP CON
123.85 348.3
UNICOM 123.0 (CTAF)

A 1559









CATEGORY	A	B	C	D
CIRCLING	1180-1¼ 941 (1000-1¼)		NA	

DME MINIMA

CIRCLING	1000-1 761 (800-1)	1040-1¼ 801 (900-1¼)	NA	

Use Providence altimeter setting.
ACTIVATE MIRL Rwy 13-31-UNICOM.
▽
△NA

MIRL Rwy 13-31

FAF to MAP 8.5 NM					
Knots	60	90	120	150	180
Min:Sec	8:30	5:40	4:15	3:24	2:50

VOR-A

41°49'N – 71°54'W

DANIELSON, CONNECTICUT
DANIELSON (5B3)

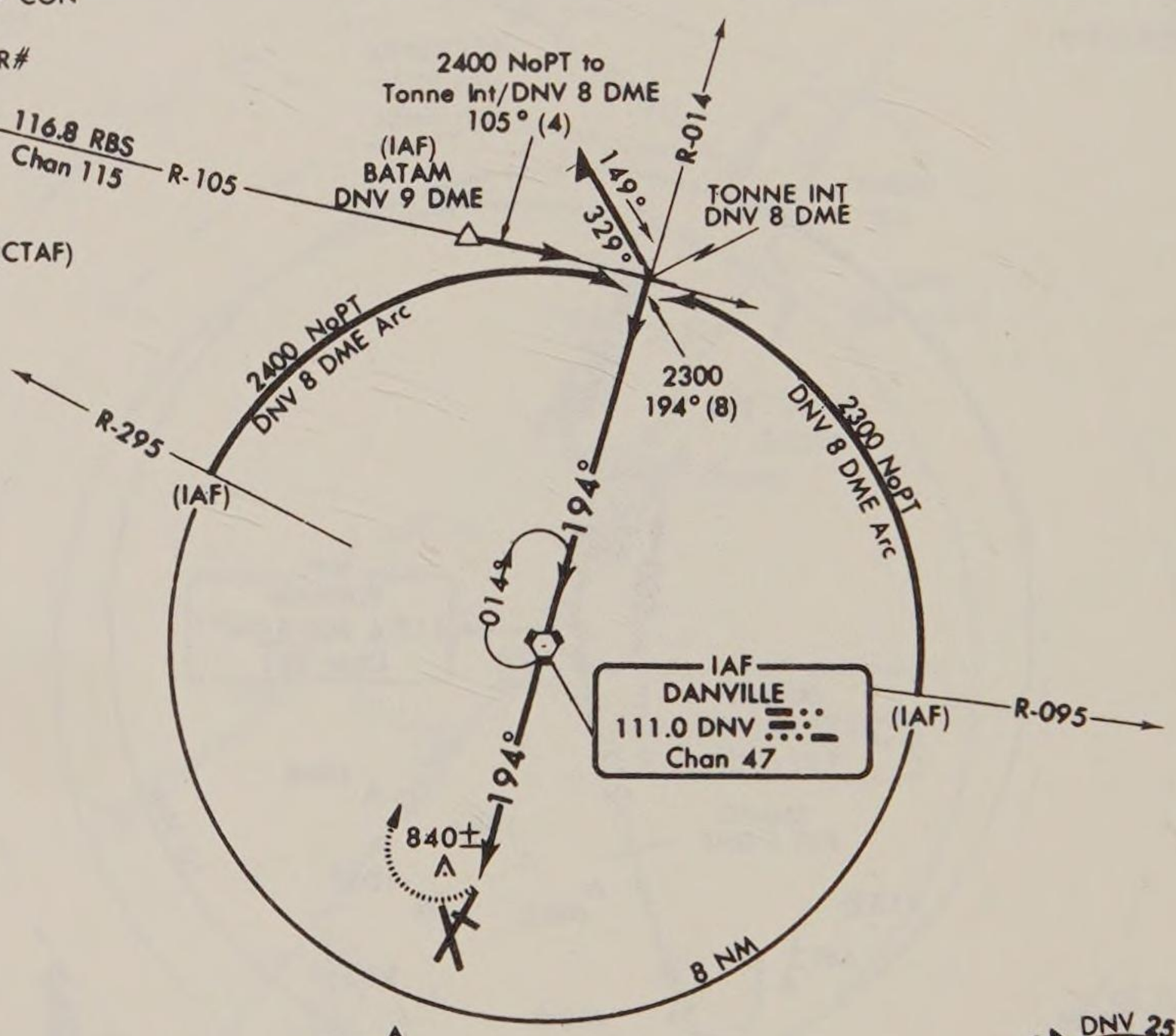
Not for use in Navigation

Amdt 11

VOR RWY 21

DANVILLE/VERMILION CO (DNV)
DANVILLE, ILLINOIS

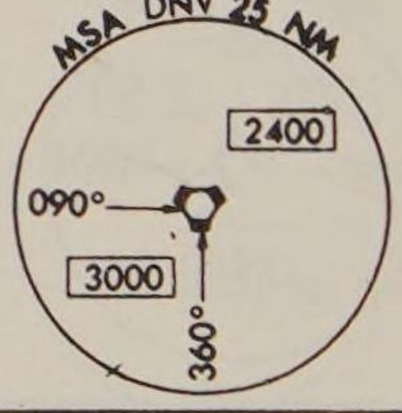
CHAMPAIGN APP CON
121.35 291.0
DANVILLE TOWER#
124.0
GND CON
121.8
CLNC DEL
121.8
UNICOM 122.7 (CTAF)



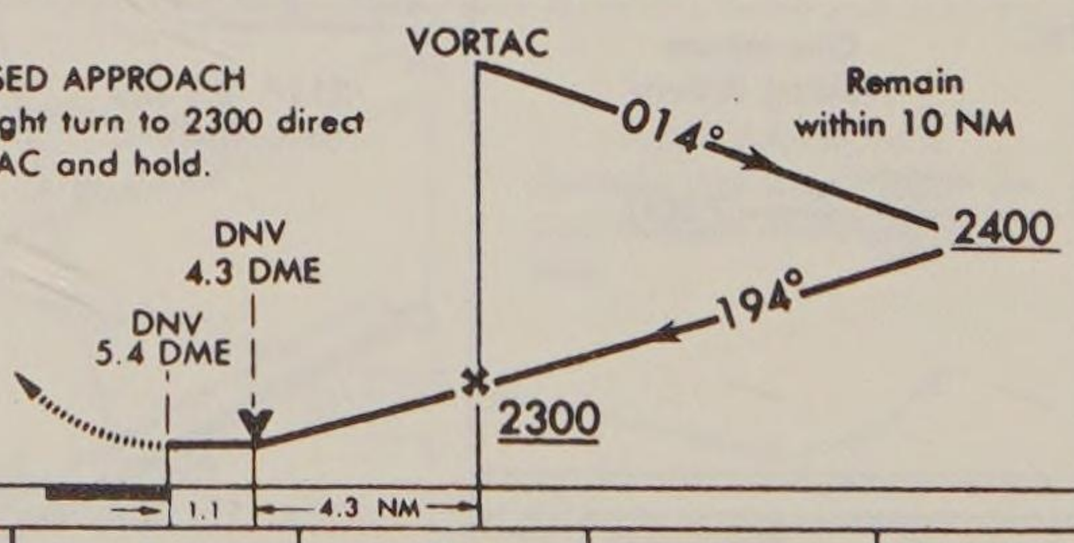
1047

Obtain local altimeter setting on UNICOM; when not available, except for operators with approved weather reporting service, use Lafayette altimeter setting.
Cat D S-21 visibility increased ¼ mile for inoperative MALSR.

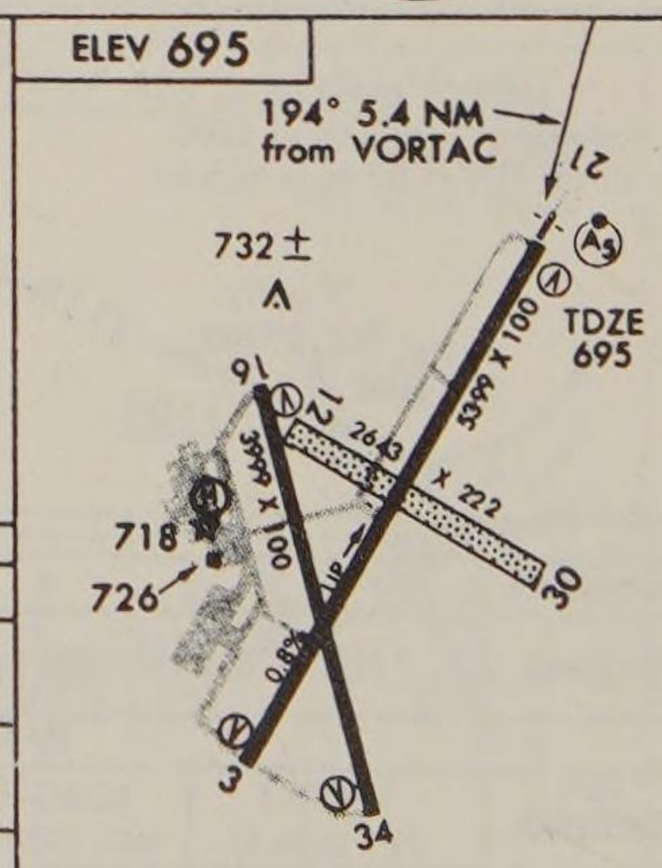
1999



MISSED APPROACH
Climbing right turn to 2300 direct DNV VORTAC and hold.



ELEV 695



CATEGORY	A	B	C	D
S-21	1100-½ 405 (500-½)		1100-¾ 405 (500-¾)	1100-1 405 (500-1)
CIRCLING	1140-1 445 (500-1)	1160-1 465 (500-1)	1160-1½ 465 (500-1½)	1260-2 565 (600-2)
LAFAYETTE ALTIMETER SETTING MINIMUMS				
S-21	1240-½ 545 (600-½)		1240-¾ 545 (600-¾)	1240-1 545 (600-1)
CIRCLING	1280-1 585 (600-1)		1280-1½ 585 (600-1½)	1280-2 585 (600-2)

ACTIVATE MALSR Rwy 21; HIRL Rwy 3-21; MIRL Rwy 16-34, VASI Rwys 16, 34, 3, 21; REIL Rwys 3, 16, 34-CTAF.

MIRL Rwy 16-34
HIRL Rwy 3-21
REIL Rwys 3, 16 and 34

706±

FAF to MAP 5.4 NM

Knots	60	90	120	150	180
Min:Sec	5:24	3:36	2:42	2:10	1:48

VOR RWY 21

40°12'N – 87°36'W

DANVILLE, ILLINOIS
DANVILLE/VERMILION CO (DNV)

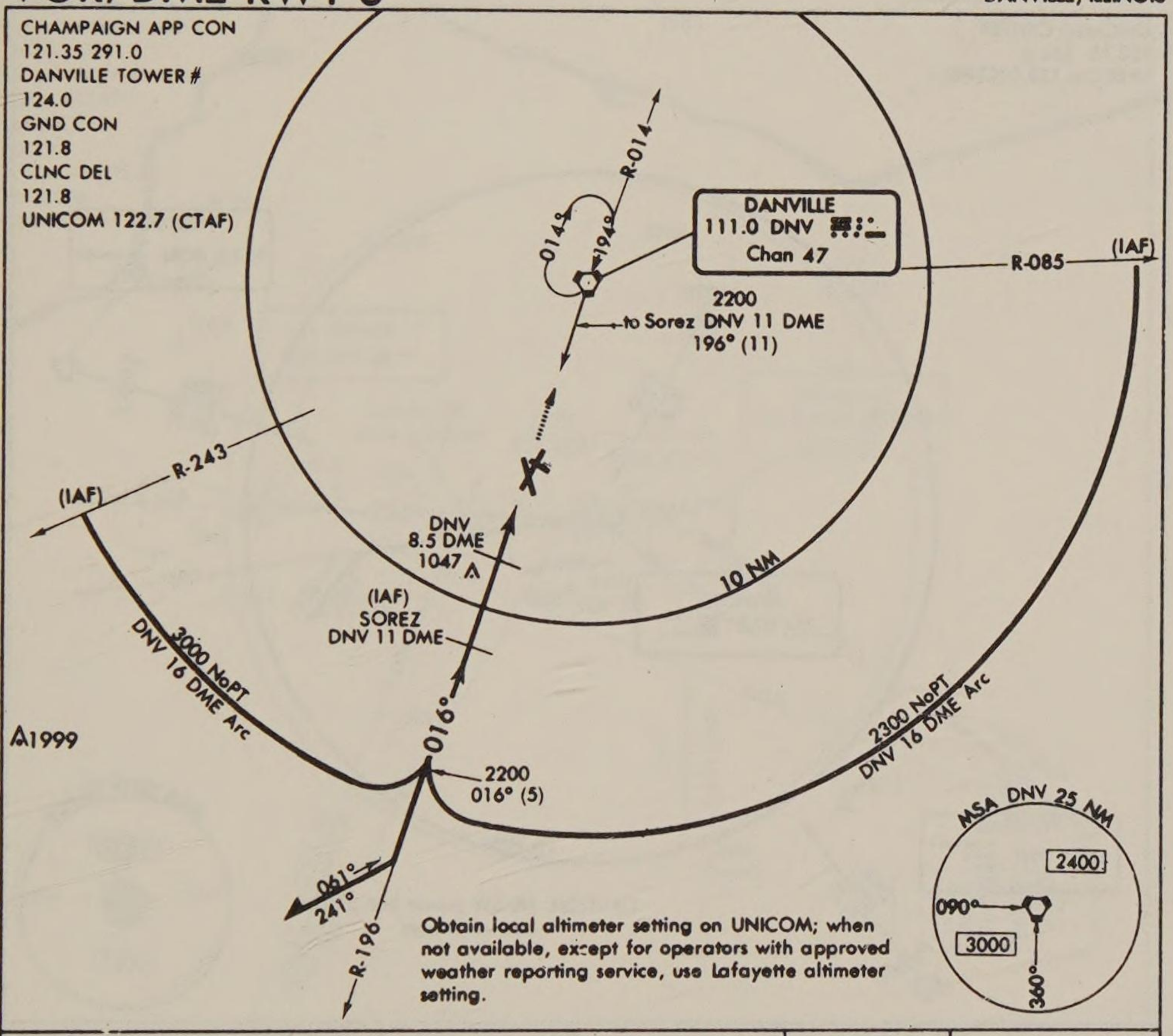
Not for use in Navigation

Amdt 9

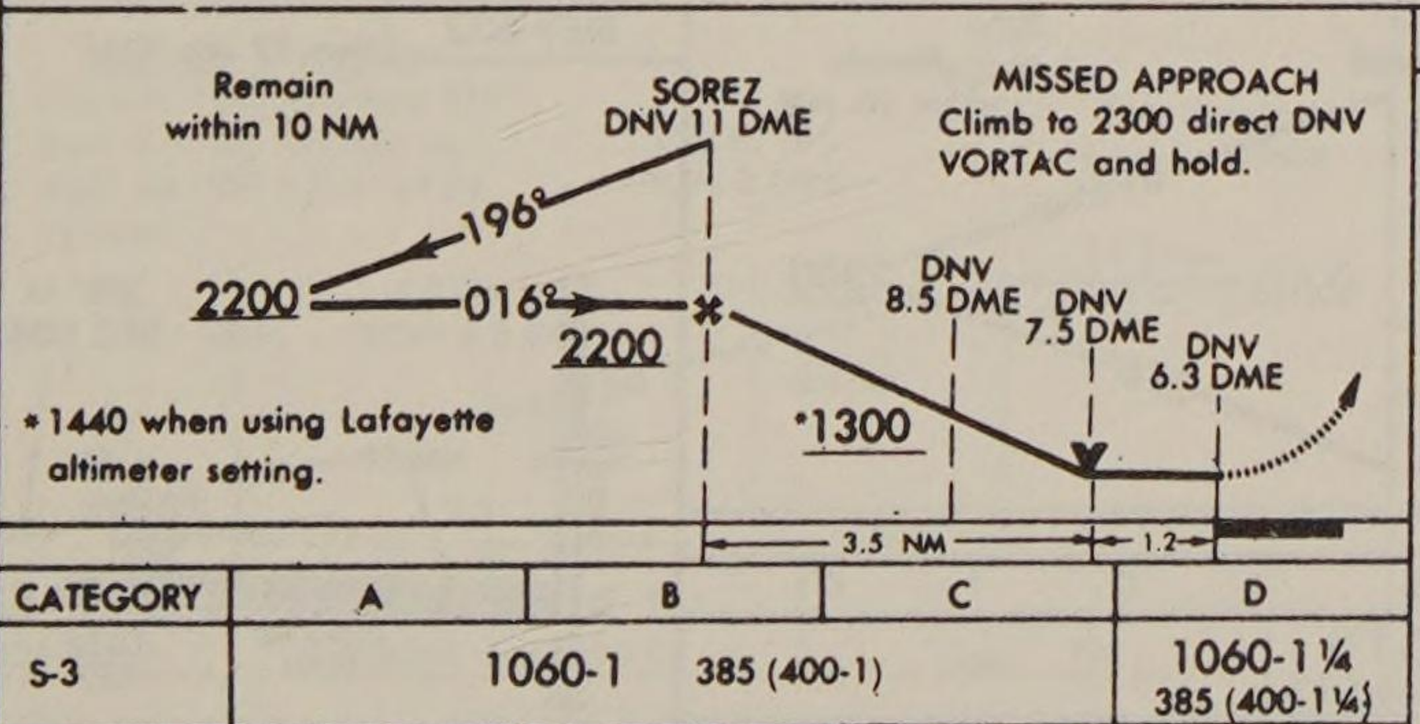
VOR/DME RWY 3

DANVILLE/VERMILION CO (DNV)
DANVILLE, ILLINOIS

CHAMPAIGN APP CON
121.35 291.0
DANVILLE TOWER #
124.0
GND CON
121.8
CLNC DEL
121.8
UNICOM 122.7 (CTAF)



Obtain local altimeter setting on UNICOM; when not available, except for operators with approved weather reporting service, use Lafayette altimeter setting.

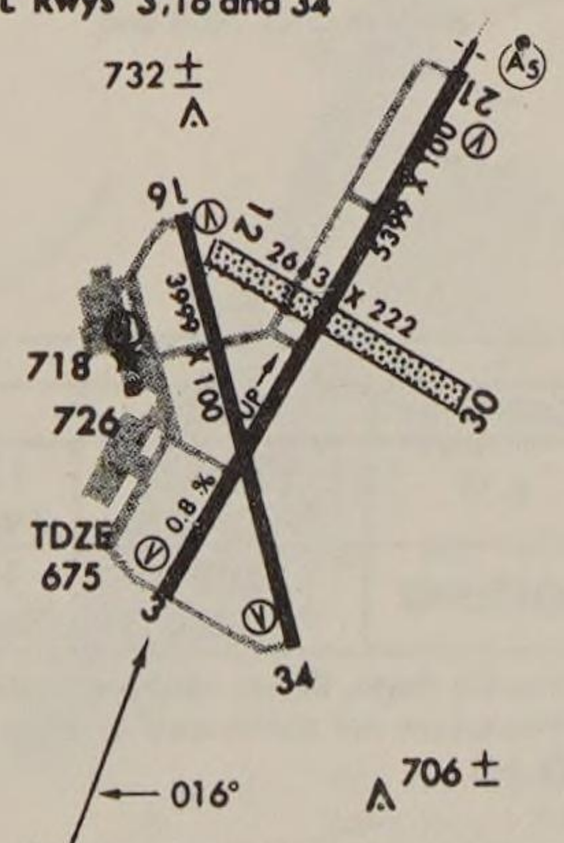


CATEGORY	A	B	C	D
S-3	1060-1 385 (400-1)			1060-1¼ 385 (400-1¼)
CIRCLING	1140-1 445 (500-1)	1160-1 465 (500-1)	1160-1½ 465 (500-1½)	1260-2 565 (600-2)
LAFAYETTE ALTIMETER SETTING MINIMUMS				
S-3	1200-1 525 (600-1)			1200-1¼ 525 (600-1¼)
CIRCLING	1280-1 585 (600-1)		1280-1½ 585 (600-1½)	1280-2 585 (600-2)

ACTIVATE MALSR Rwy 21; HIRL Rwy 3-21; MIRL Rwy 16-34; VASI Rwys 16, 34, 3, 21; REIL Rwys 3, 16, 34-CTAF. ⚠

ELEV 695

MIRL Rwy 16-34
HIRL Rwy 3-21
REIL Rwys 3,16 and 34



Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 3

40°12'N-87°36'W

DANVILLE, ILLINOIS
DANVILLE/VERMILION CO (DNV)

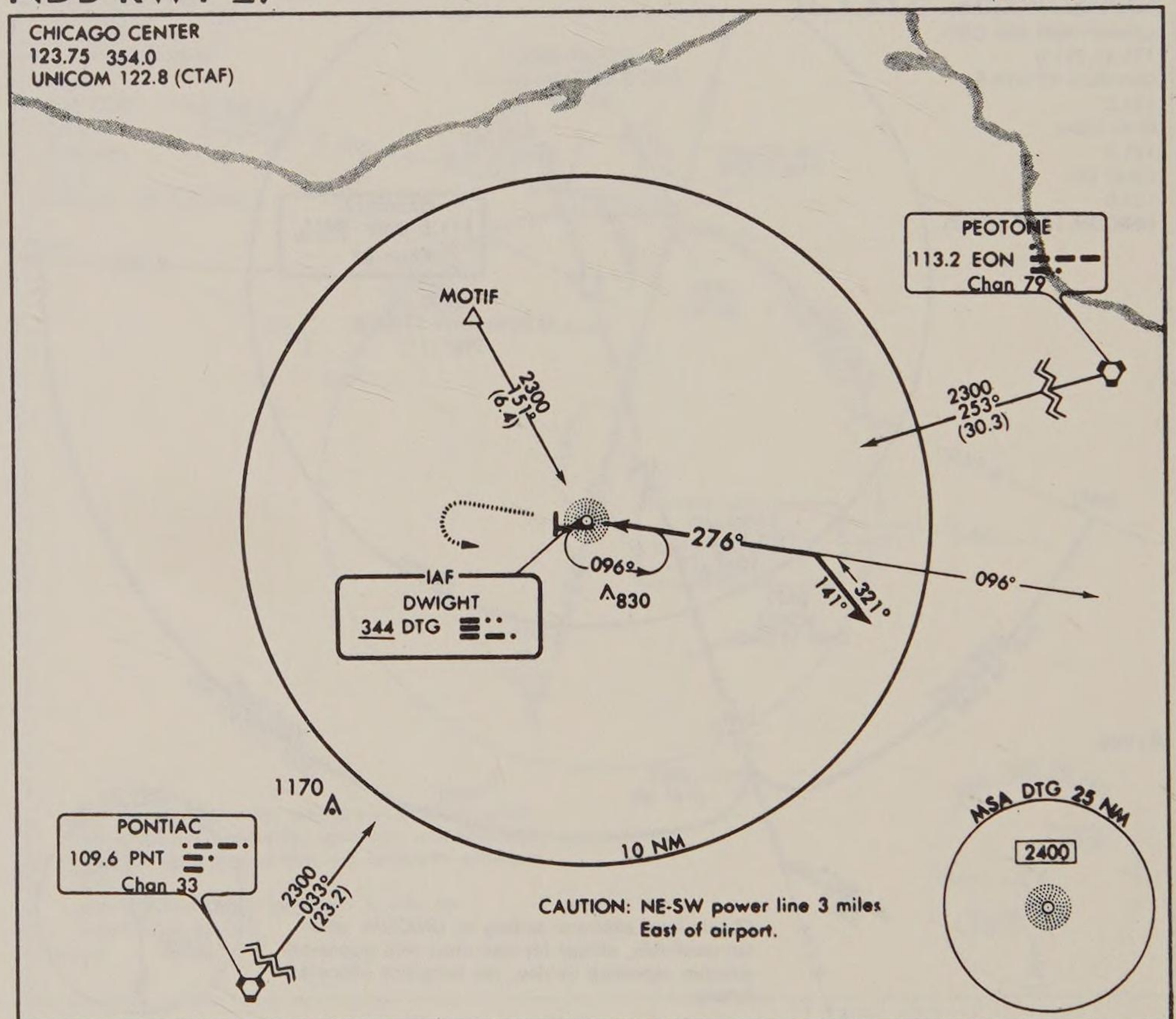
Not for use in Navigation

Amdt 1

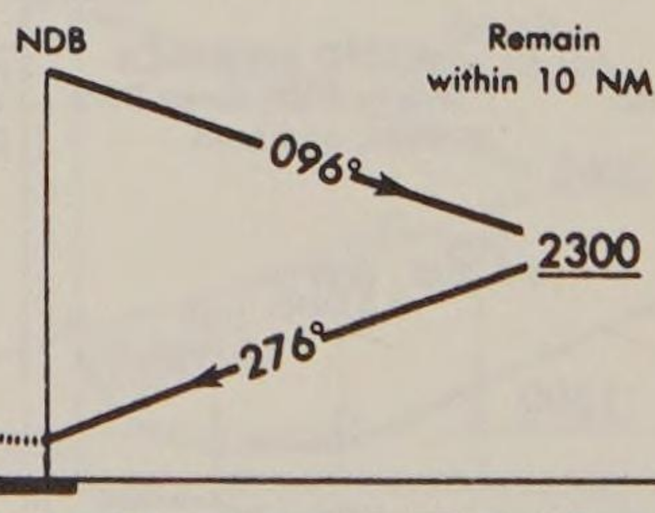
NDB RWY 27

DWIGHT (DTG)
DWIGHT, ILLINOIS

CHICAGO CENTER
123.75 354.0
UNICOM 122.8 (CTAF)



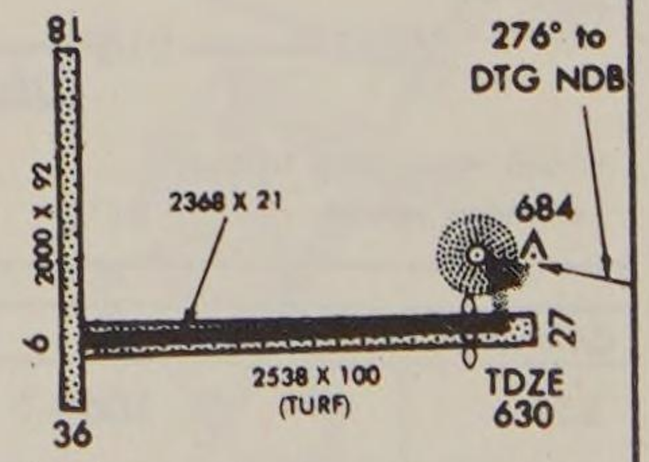
MISSED APPROACH
Climb to 2300 left turn direct to DTG NDB and hold.



CATEGORY	A	B	C	D
S-27	1380-1 750 (800-1)	1380-1 ¼ 750 (800-1 ¼)	NA	
CIRCLING	1380-1 750 (800-1)	1380-1 ¼ 750 (800-1 ¼)	NA	

Use Du Page, Illinois altimeter setting.
Procedure not authorized at night.
⚠ NA

ELEV 632
Rwy 27 ldg 2246'



REIL Rwy 27
LIRL Rwy 9-27

Knots	60	90	120	150	180
Min:Sec					

NDB RWY 27

41°08'N – 88°26'W

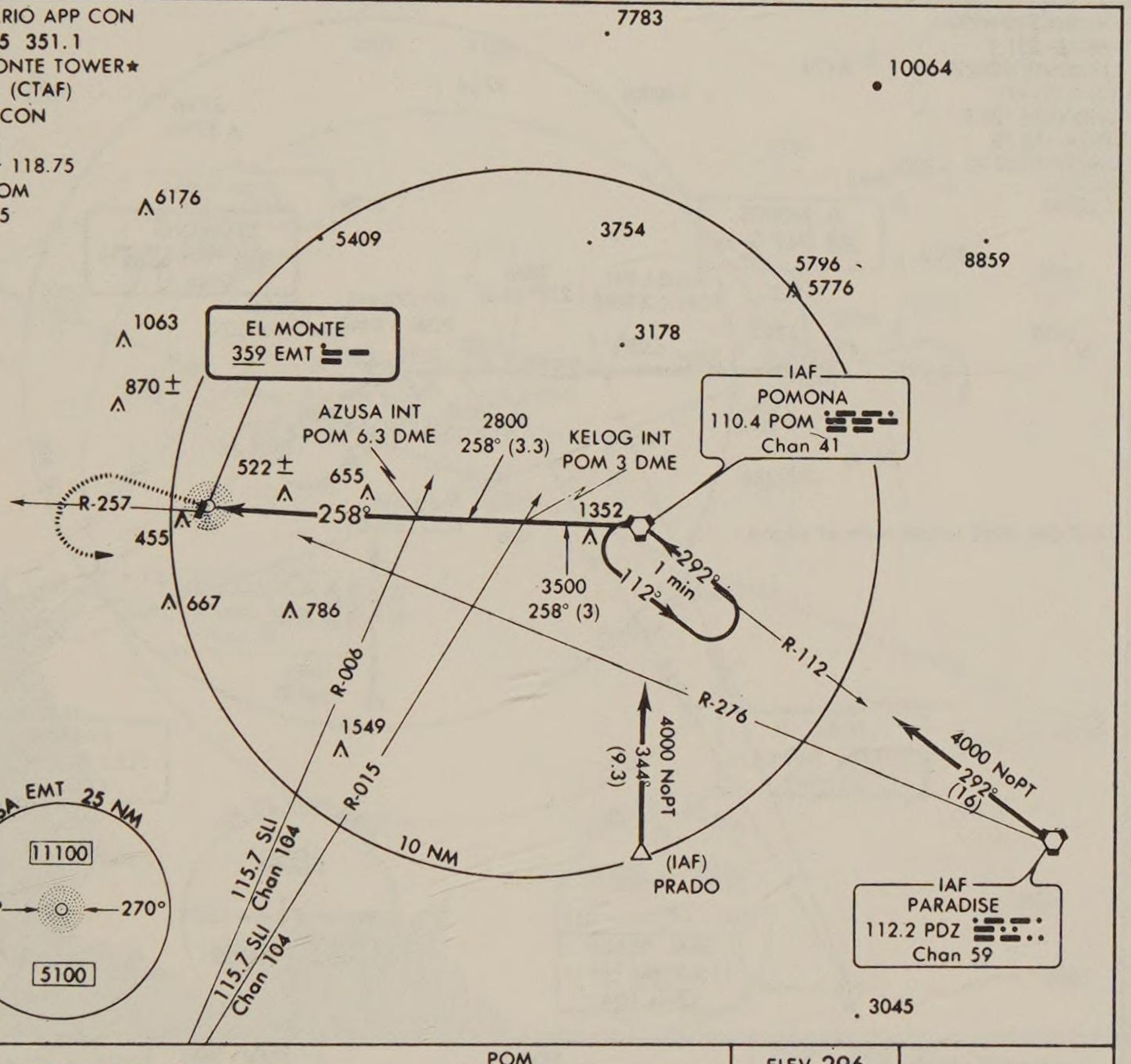
DWIGHT, ILLINOIS
DWIGHT (DTG)

Not for use in Navigation

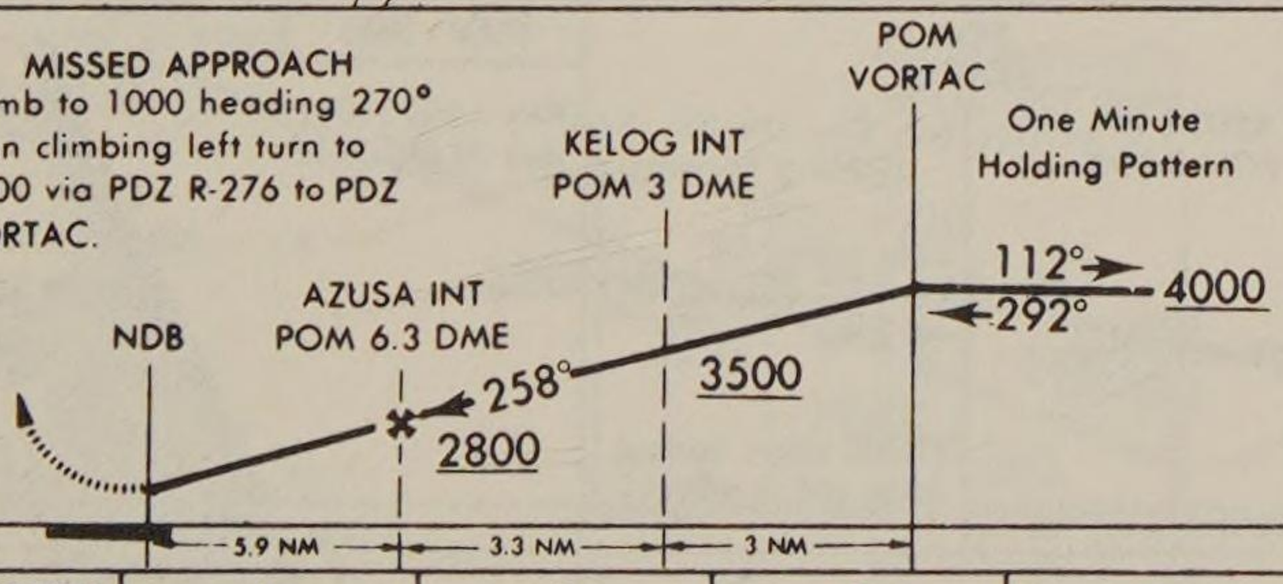
Orig
NDB-C

EL MONTE (EMT)
EL MONTE, CALIFORNIA

ONTARIO APP CON
119.65 351.1
EL MONTE TOWER★
121.2 (CTAF)
GND CON
125.9
ATIS★ 118.75
UNICOM
122.95



MISSED APPROACH
Climb to 1000 heading 270° then climbing left turn to 4000 via PDZ R-276 to PDZ VORTAC.

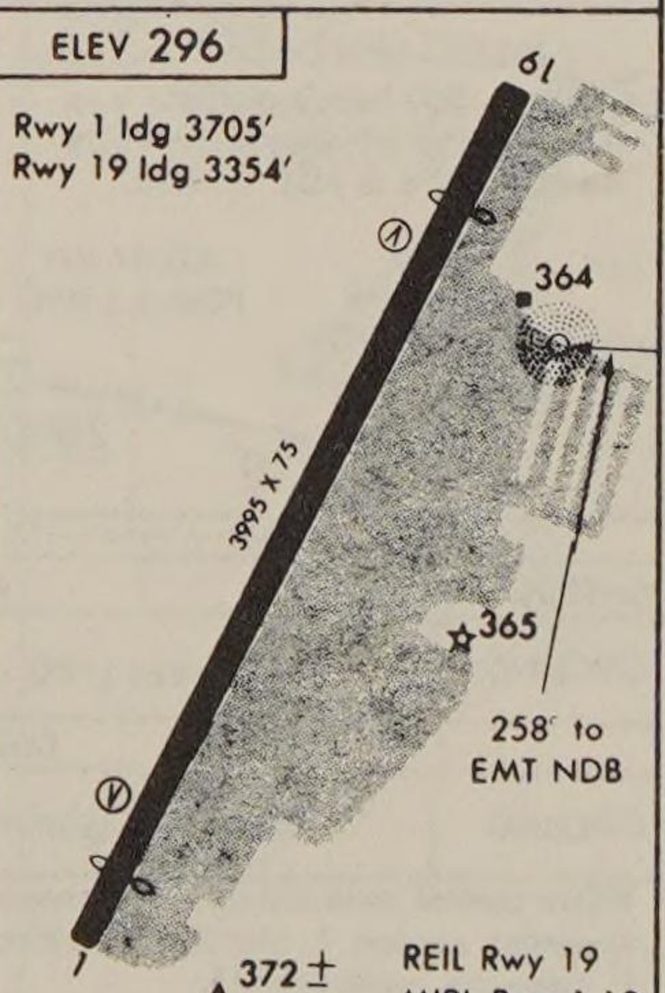


CATEGORY	A	B	C	D
CIRCLING	960-1 664 (700-1)		NA	

When control zone not in effect the following applies except for operators with approved weather reporting service: 1. Use Ontario altimeter setting. 2. Increase MDAs 80 feet. 3. Alternate minimums not authorized.

ELEV 296

Rwy 1 ldg 3705'
Rwy 19 ldg 3354'



Knots	60	90	120	150	180
Min:Sec					

NDB-C

34°05'N-118°02'W

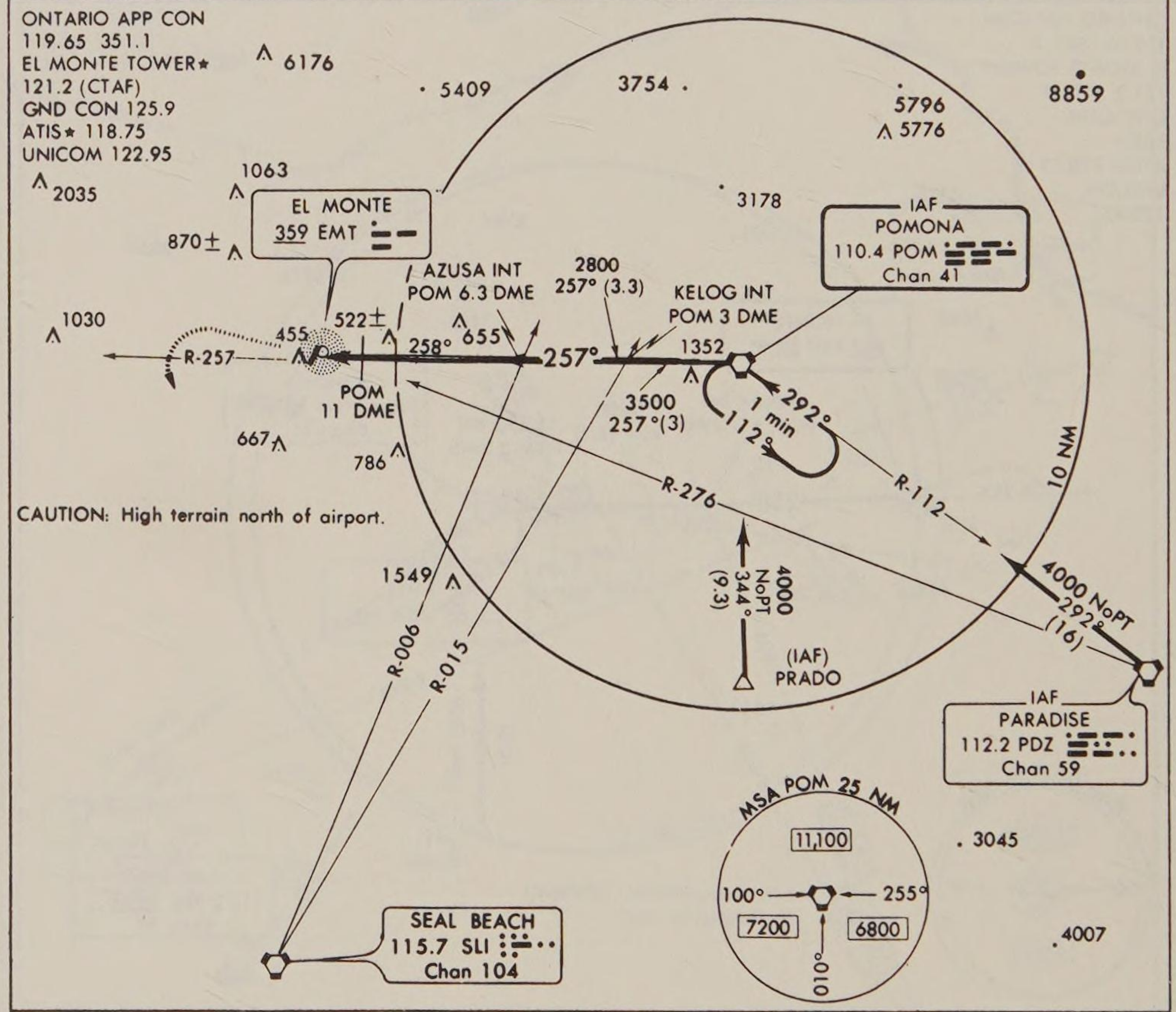
EL MONTE, CALIFORNIA
EL MONTE (EMT)

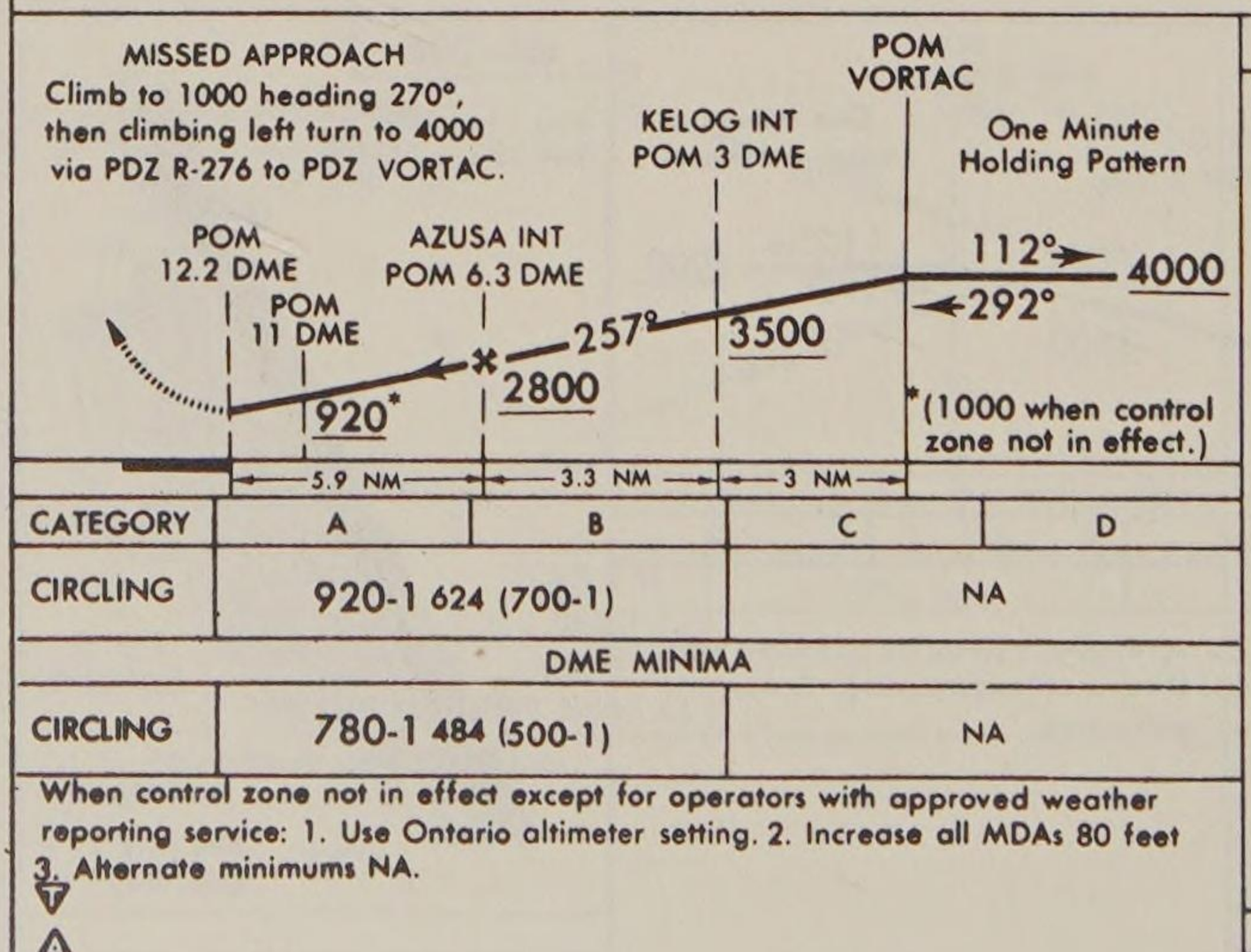
Not for use in Navigation

Amdt 5

VOR-A

EL MONTE (EMT)
EL MONTE, CALIFORNIA



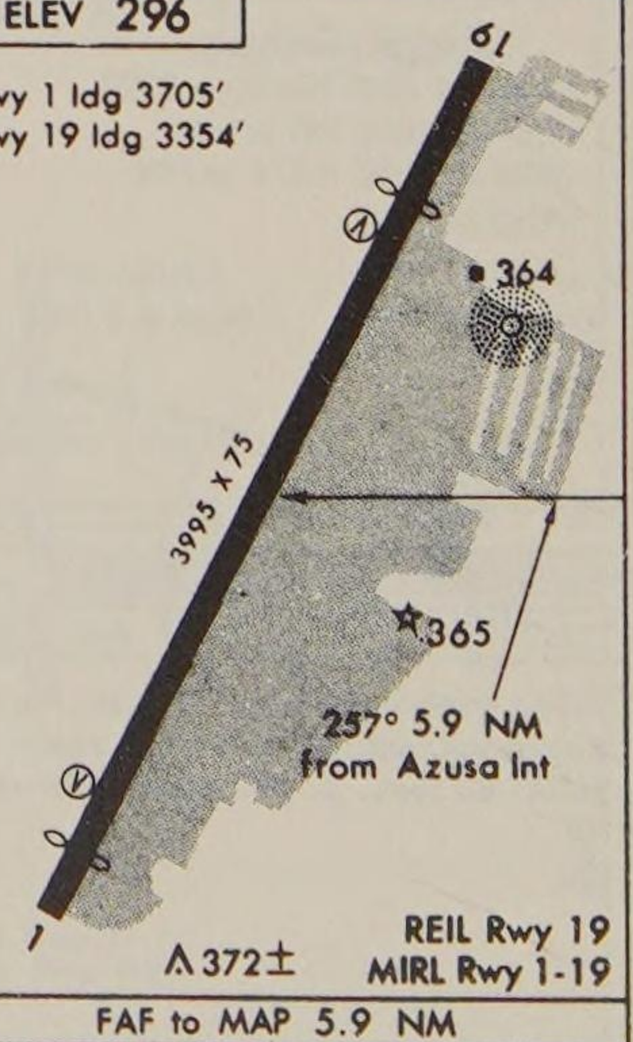


CATEGORY	A	B	C	D
CIRCLING	920-1 624 (700-1)		NA	
DME MINIMA				
CIRCLING	780-1 484 (500-1)		NA	

When control zone not in effect except for operators with approved weather reporting service: 1. Use Ontario altimeter setting. 2. Increase all MDAs 80 feet 3. Alternate minimums NA.

ELEV 296

Rwy 1 ldg 3705'
Rwy 19 ldg 3354'



FAF to MAP 5.9 NM					
Knots	60	90	120	150	180
Min:Sec	5:54	3:56	2:57	2:22	1:58

VOR-A

34°05'N – 118°02'W

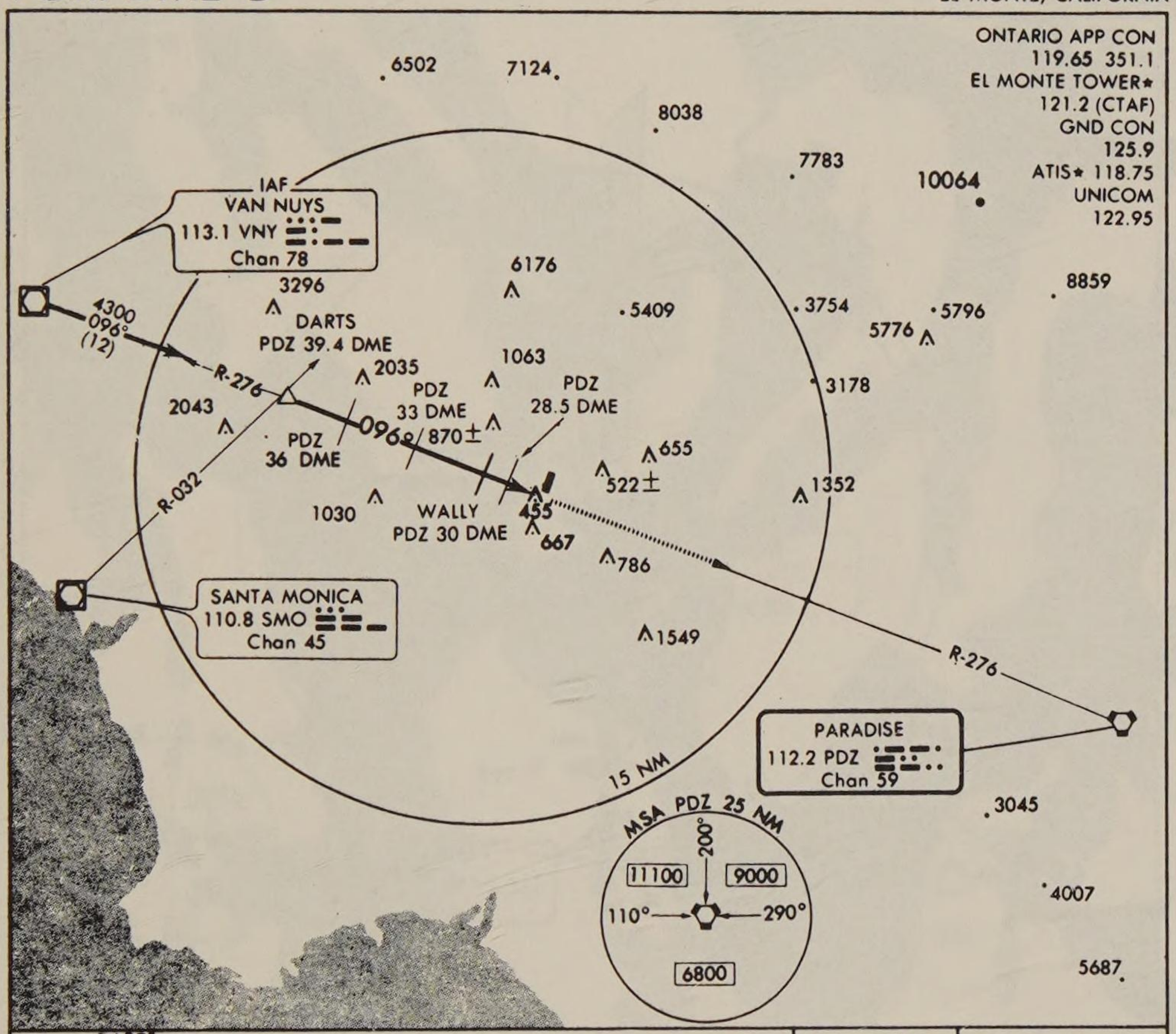
EL MONTE, CALIFORNIA
EL MONTE (EMT)

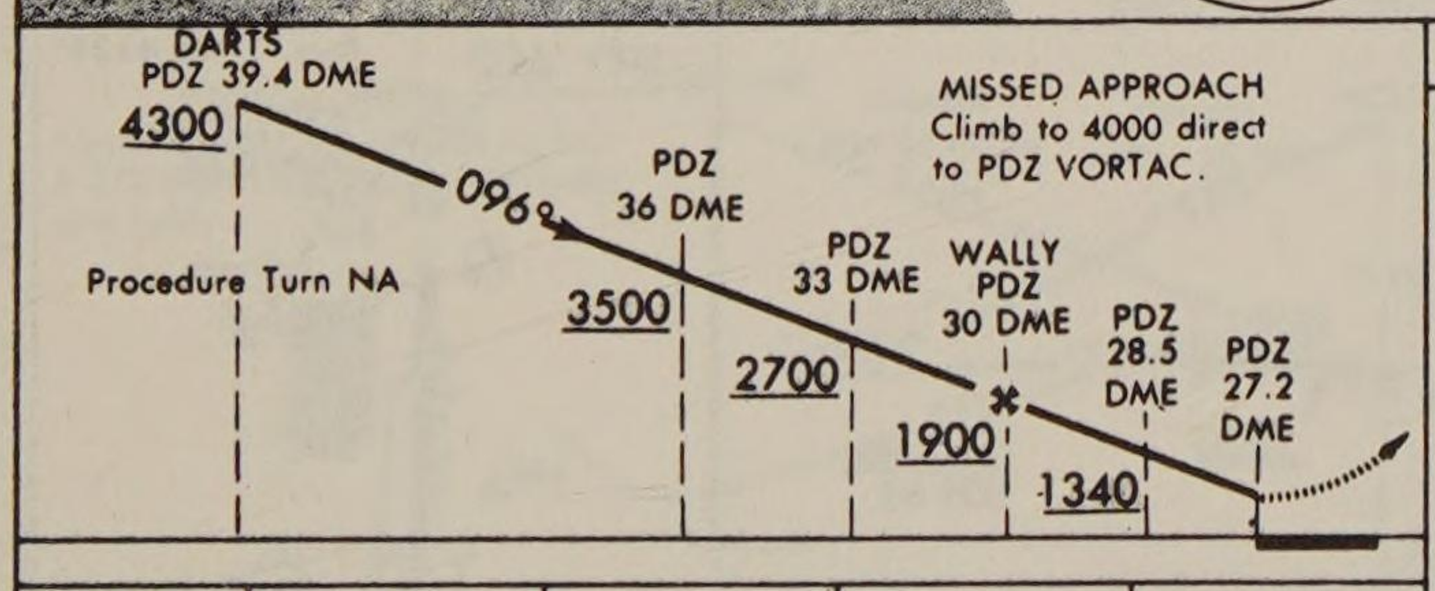
Not for use in Navigation

Amdt 1

VOR/DME-B

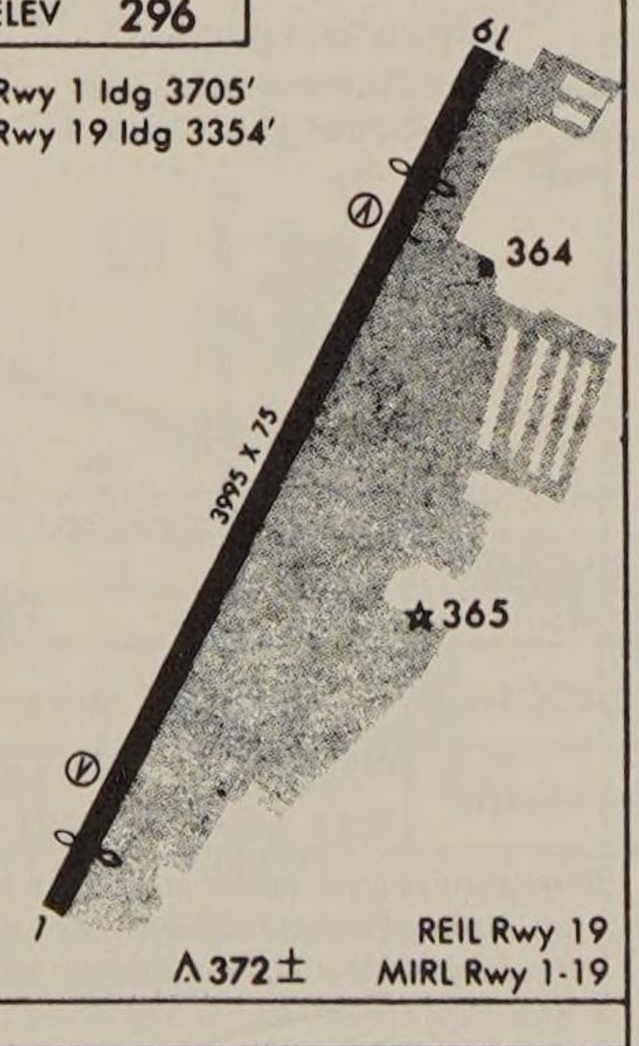
EL MONTE (EMT)
EL MONTE, CALIFORNIA





ELEV 296

Rwy 1 ldg 3705'
Rwy 19 ldg 3354'



CATEGORY	A	B	C	D
CIRCLING	940-1 644(700-1)		NA	

When control zone not in effect, the following applies except for operators with approved weather reporting service: 1. Use Ontario, CA altimeter setting. 2.Increase MDAs 80 feet. 3. Alternate minimums not authorized.

T
A

Knots	60	90	120	150	180
Min:Sec					

VOR/DME-B

34°05'N – 118°02'W

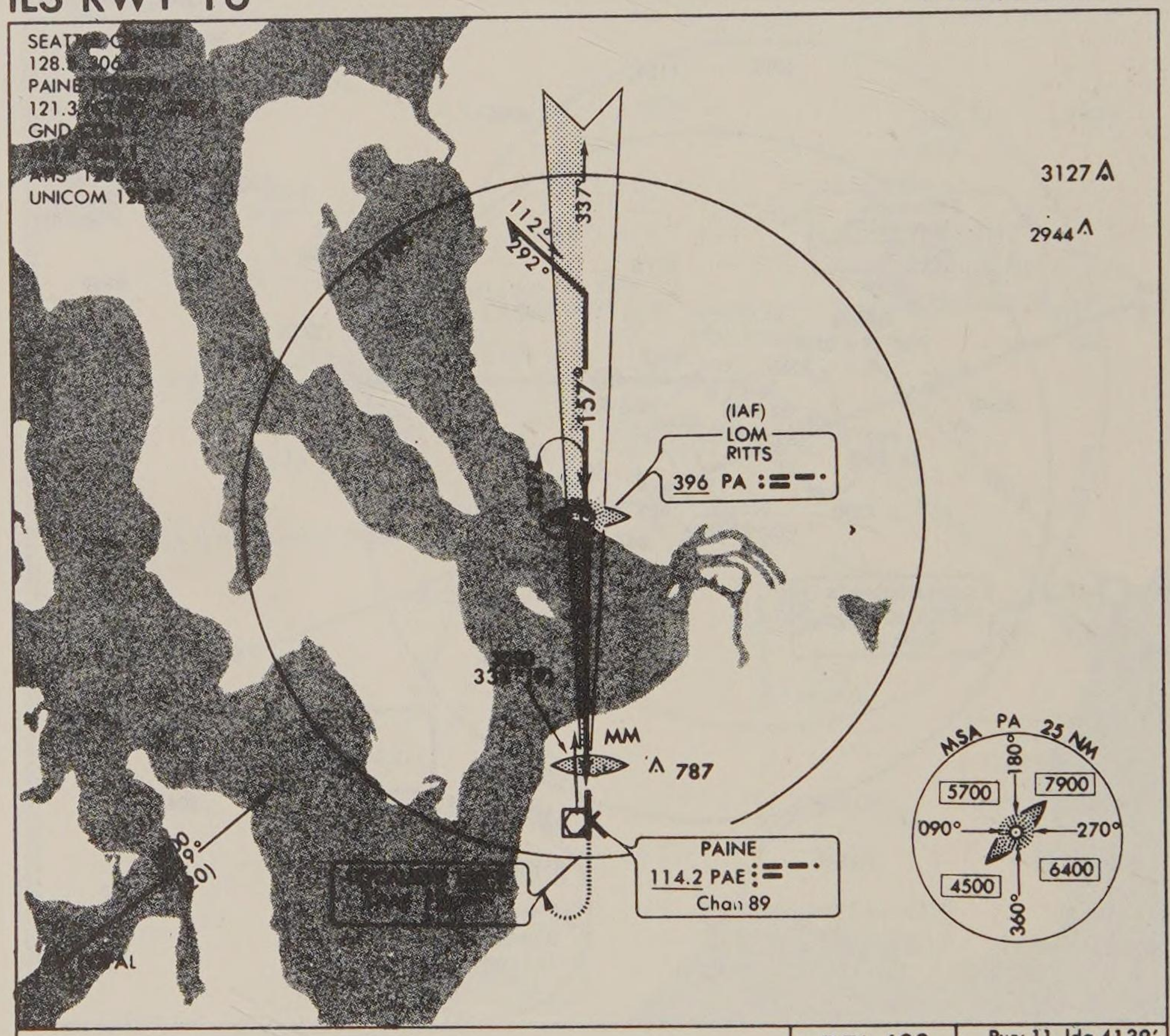
EL MONTE, CALIFORNIA
EL MONTE (EMT)

Not for use in Navigation

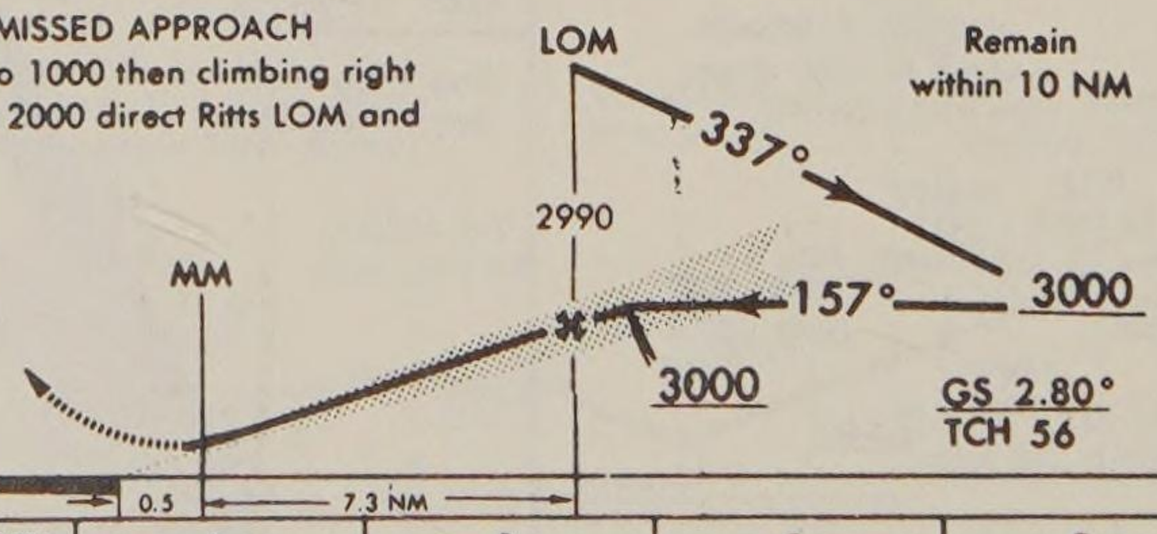
Amdt 16

ILS RWY 16

EVERETT/SNOHOMISH CO (PAINE FLD) (PAE)
EVERETT, WASHINGTON

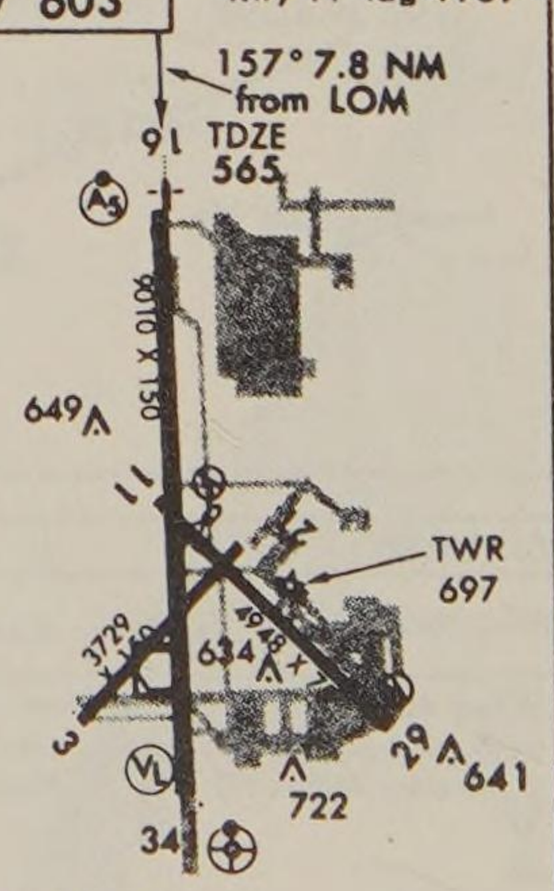


MISSED APPROACH
Climb to 1000 then climbing right turn to 2000 direct Ritts LOM and hold.



ELEV 603

Rwy 11 ldg 4139'



MIRL Rwy 11-29
HIRL Rwy 16-34

CATEGORY	A	B	C	D
S-ILS 16	765/24 200 (200-½)			
S-LOC 16	980/24 415 (400-½)		980/40 415 (400-¾)	
CIRCLING	1040-1 437 (500-1)	1060-1 457 (500-1)	1060-1½ 457 (500-1½)	1160-2 557 (600-2)

When control zone not in effect, the following applies:
1. Use Boeing Field altimeter setting.
2. Increase all DH/MDAs 100 feet.
3. Alternate minimums not authorized.

Cat. D S-LOC visibility increased to RVR 5000 for inoperat ive MM.
ACTIVATE MALSR Rwy 16-121.3 TA

FAF to MAP 7.8 NM					
Knots	60	90	120	150	180
Min:Sec	7:48	5:12	3:54	3:07	2:36

ILS RWY 16

47°54'N–122°17'W

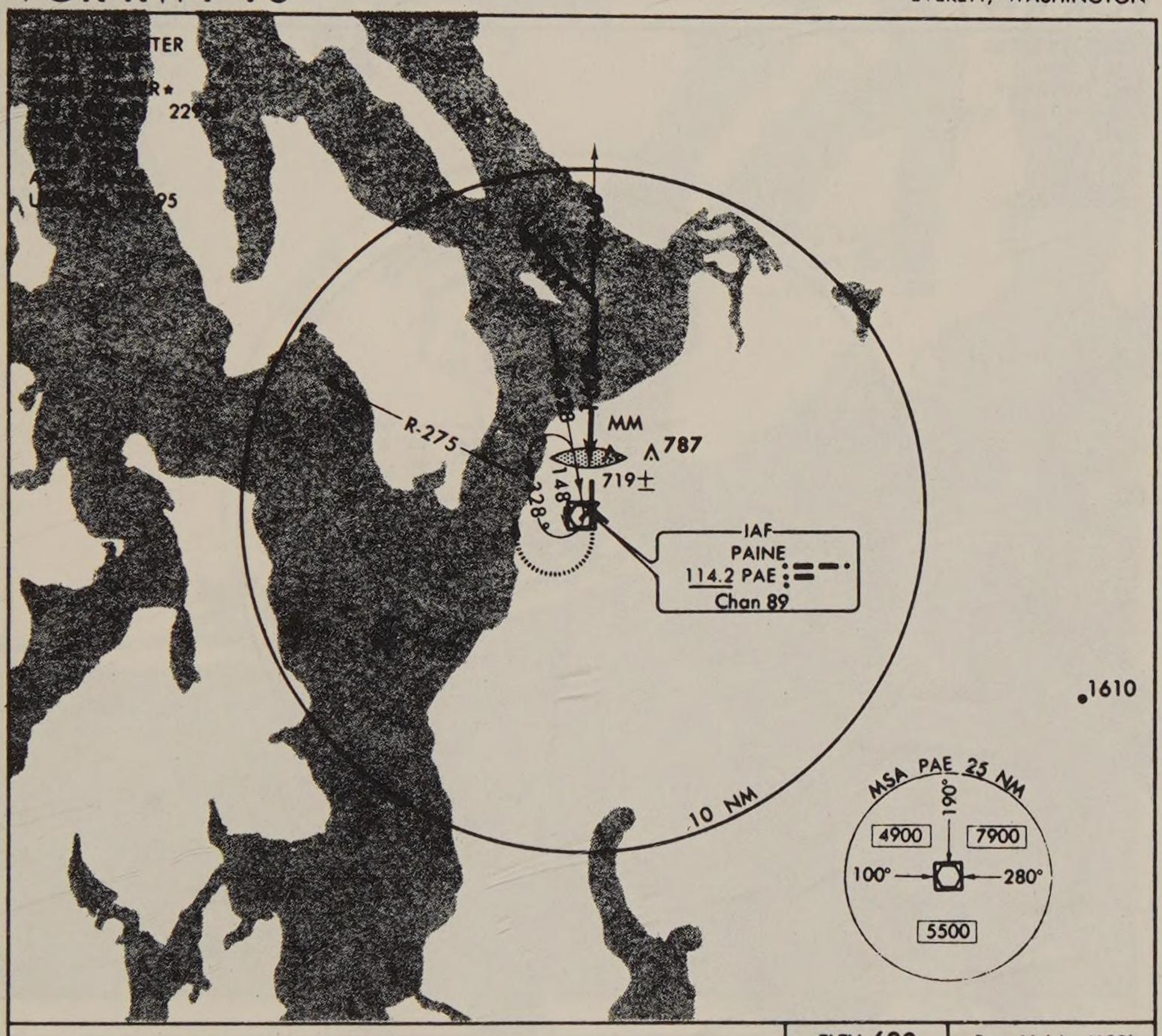
EVERETT, WASHINGTON
EVERETT/SNOHOMISH CO (PAINE FLD) (PAE)

Not for use in Navigation

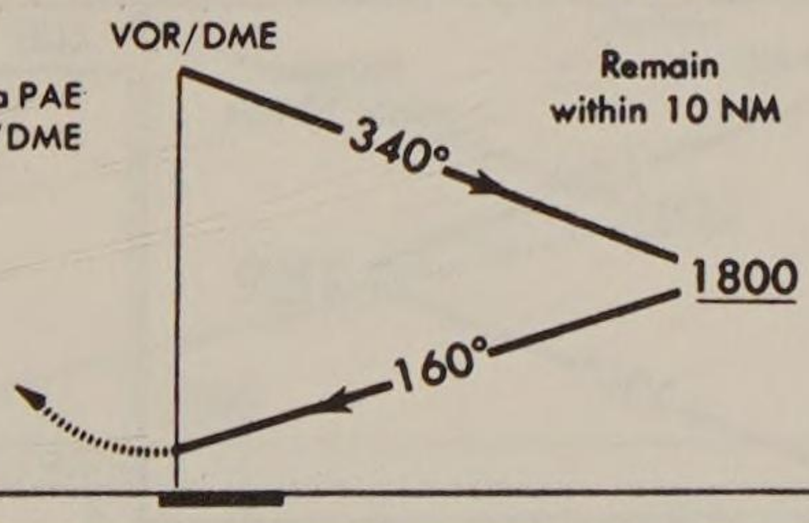
Amdt 3

VOR RWY 16

EVERETT/SNOHOMISH CO (PAINE FLD) (PAE)
EVERETT, WASHINGTON



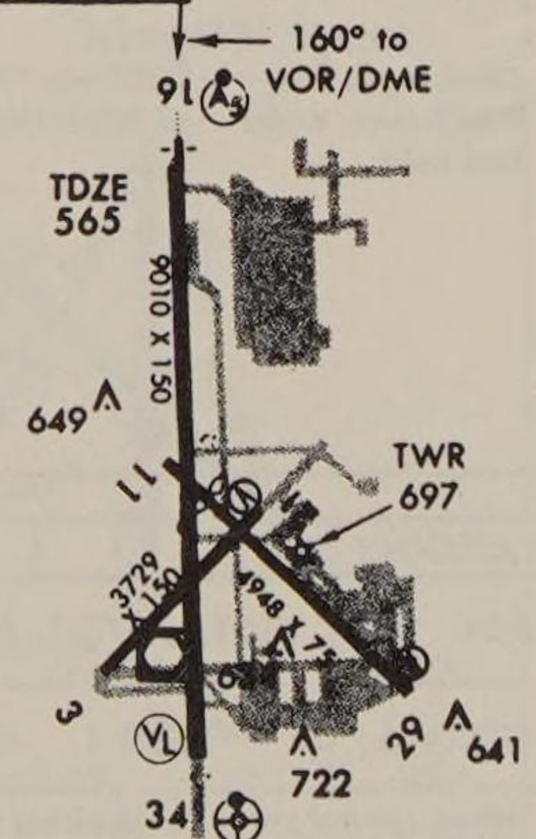
MISSED APPROACH
Climbing right turn to 2000 via PAE R-275 then direct PAE VOR/DME and hold.



CATEGORY	A	B	C	D
S-16	1020/24 455 (500-½)		1020/40 455 (500-¾)	1020/50 455 (500-1)
CIRCLING	1040-1 437 (500-1)	1060-1 457 (500-1)	1060-1½ 457 (500-1½)	1160-2 557 (600-2)

When control zone not in effect, the following applies: 1. Use Boeing Field altimeter setting. 2. Increase all MDAs 100 feet. 3. Alternate minimums not authorized.
ACTIVATE MALSR Rwy 16-121.3.

ELEV 603 — Rwy 11 ldg 4139'



HIRL Rwy 16-34
MIRL Rwy 11-29

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 16

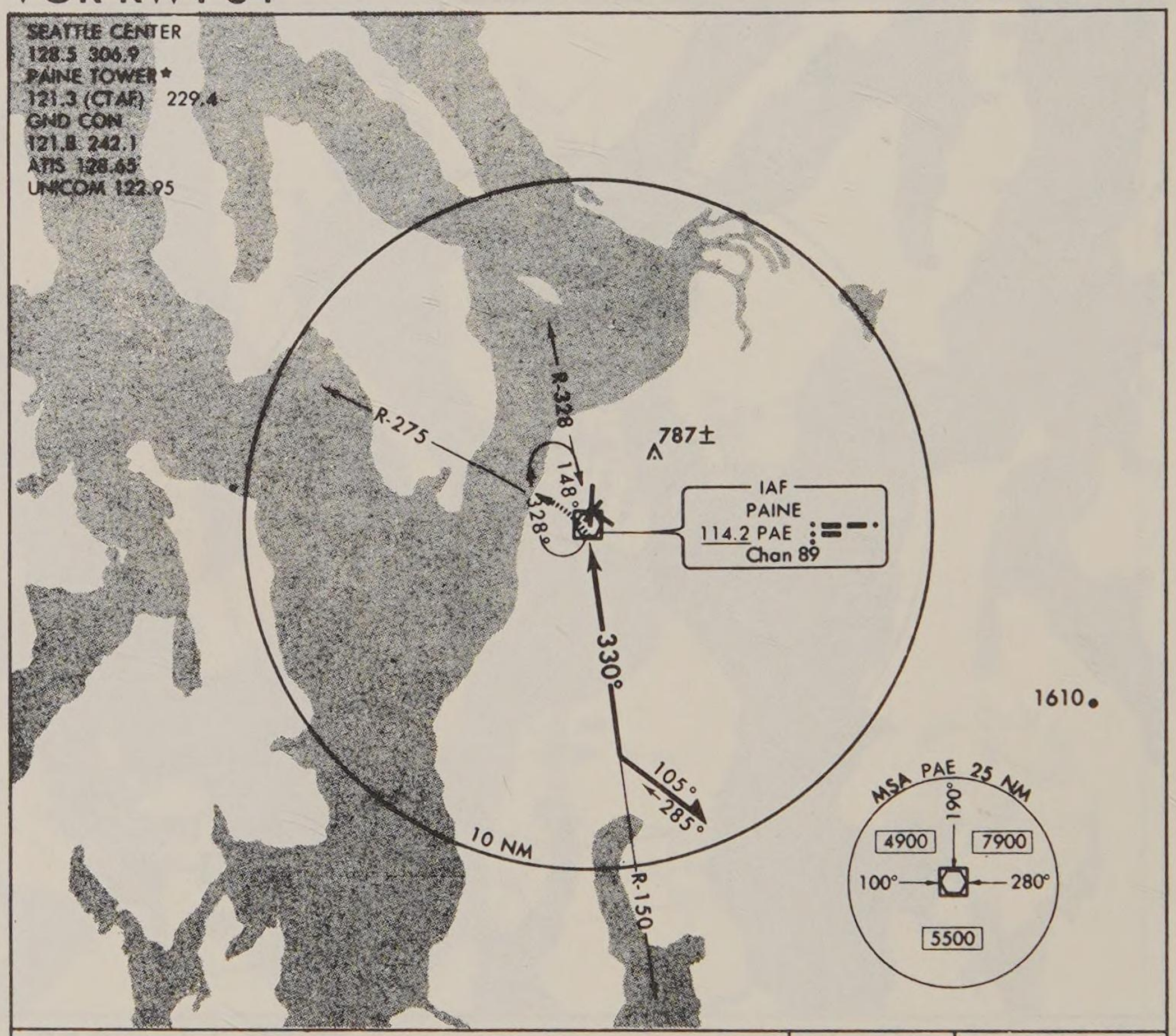
47°54'N–122°17'W
EVERETT/SNOHOMISH CO (PAINE FLD) (PAE)
EVERETT, WASHINGTON

Not for use in Navigation

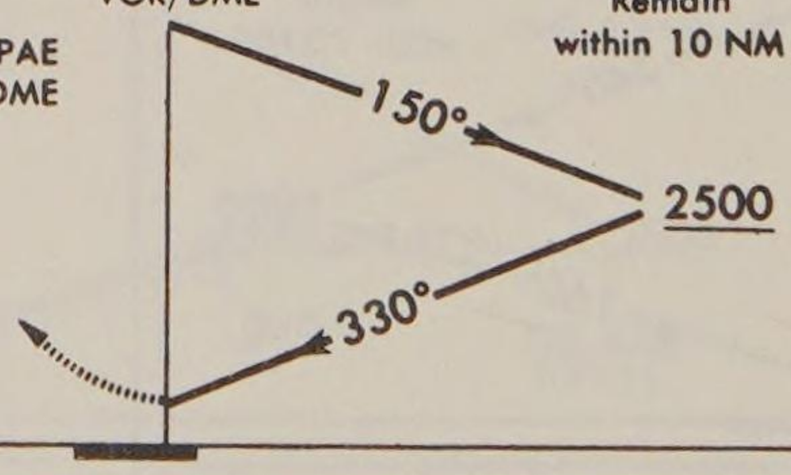
Amdt 2

VOR RWY 34

EVERETT/SNOHOMISH CO (PAINE FLD) (PAE)
EVERETT, WASHINGTON



MISSED APPROACH
Climbing left turn to 2000 via PAE R-275 then direct PAE VOR/DME and hold.

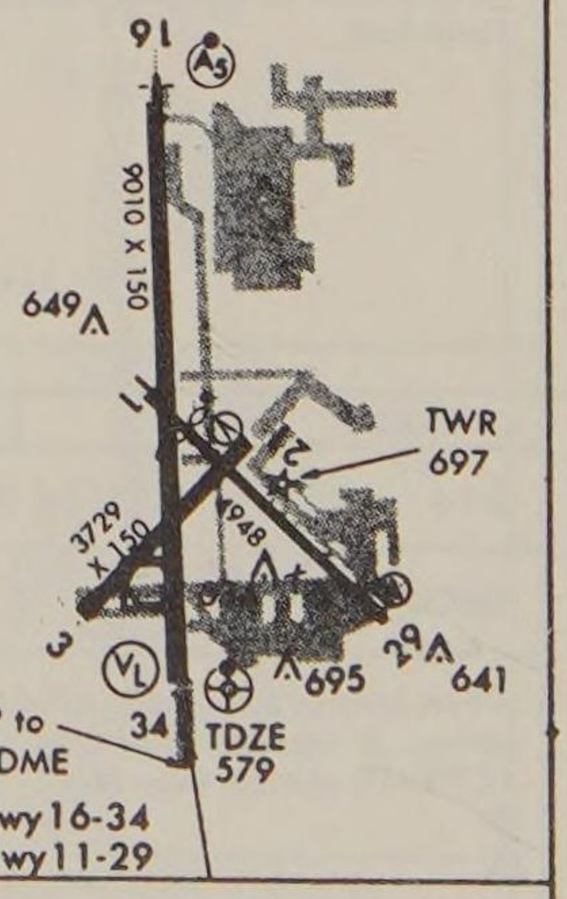


CATEGORY	A	B	C	D
S-34	1100/50	521 (500-1)	1100-1½ 521 (500-1½)	1100-1¾ 521 (500-1¾)
CIRCLING	1100-1	497 (500-1)	1100-1½ 497 (500-1½)	1160-2 557 (600-2)

When control zone not in effect the following applies: 1. Use Boeing Field altimeter setting. 2. Increase all MDAs 100 feet. 3. Alternate minimums not authorized.
ACTIVATE MALSR Rwy 16-121.3.

T
A

ELEV 603 | Rwy 11 ldg 4139'



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 34

47°54'N–122°17'W

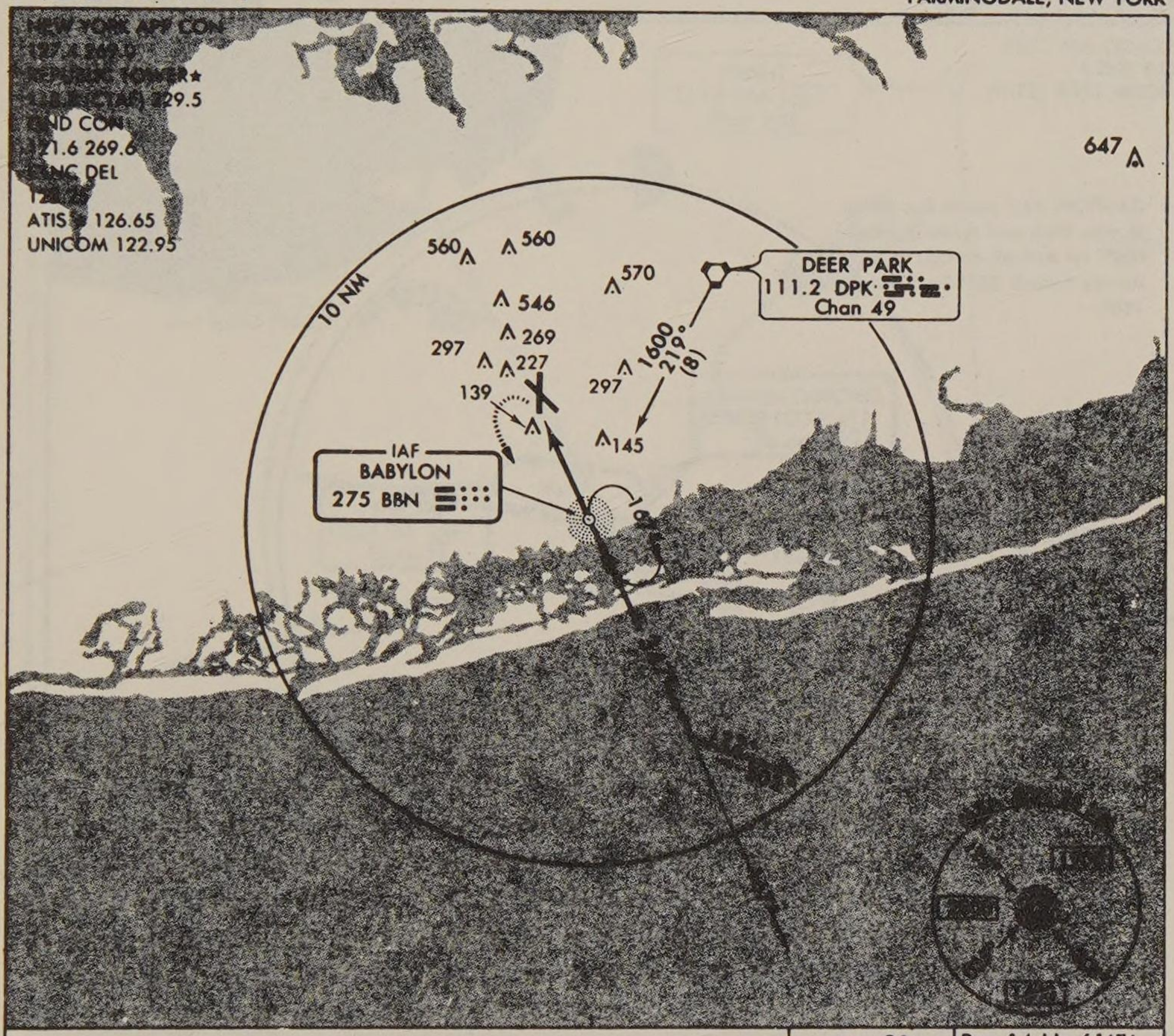
EVERETT, WASHINGTON
EVERETT/SNOHOMISH CO (PAINE FLD) (PAE)

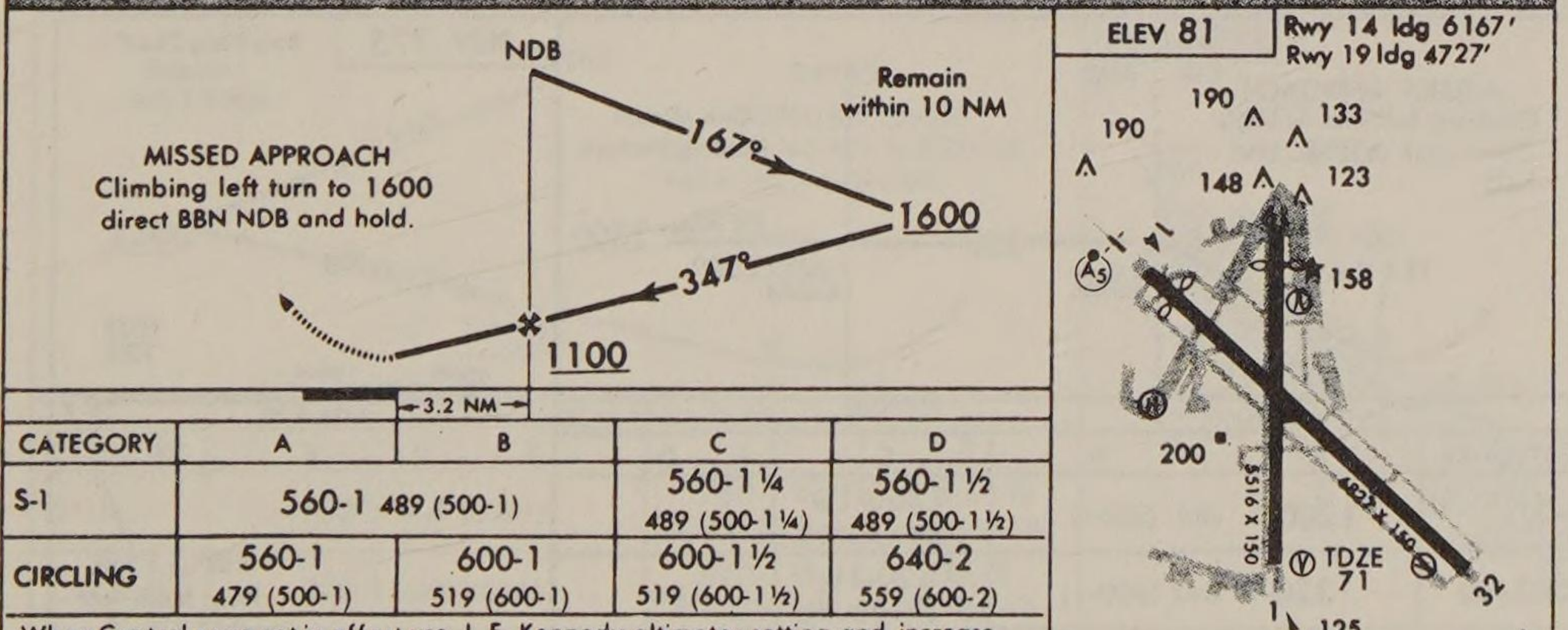
Not for use in Navigation

Amdt 12

NDB RWY 1

FARMINGDALE/REPUBLIC (FRG)
FARMINGDALE, NEW YORK





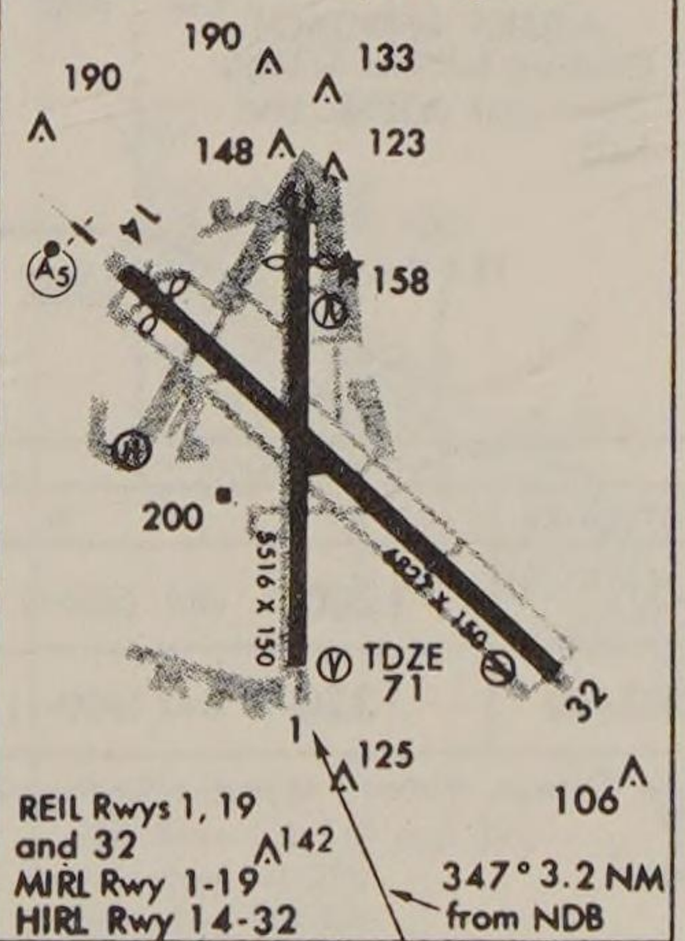
CATEGORY	A	B	C	D
S-1	560-1 489 (500-1)		560-1¼ 489 (500-1¼)	560-1½ 489 (500-1½)
CIRCLING	560-1 479 (500-1)	600-1 519 (600-1)	600-1½ 519 (600-1½)	640-2 559 (600-2)

When Control zone not in effect use J. F. Kennedy altimeter setting and increase all MDAs 60 feet.

▼
▲

ELEV 81

Rwy 14 ldg 6167'
Rwy 19 ldg 4727'



FAF to MAP 3.2 NM					
Knots	60	90	120	150	180
Min:Sec	3:12	2:08	1:36	1:17	1:04

NDB RWY 1

40°44'N-73°25'W

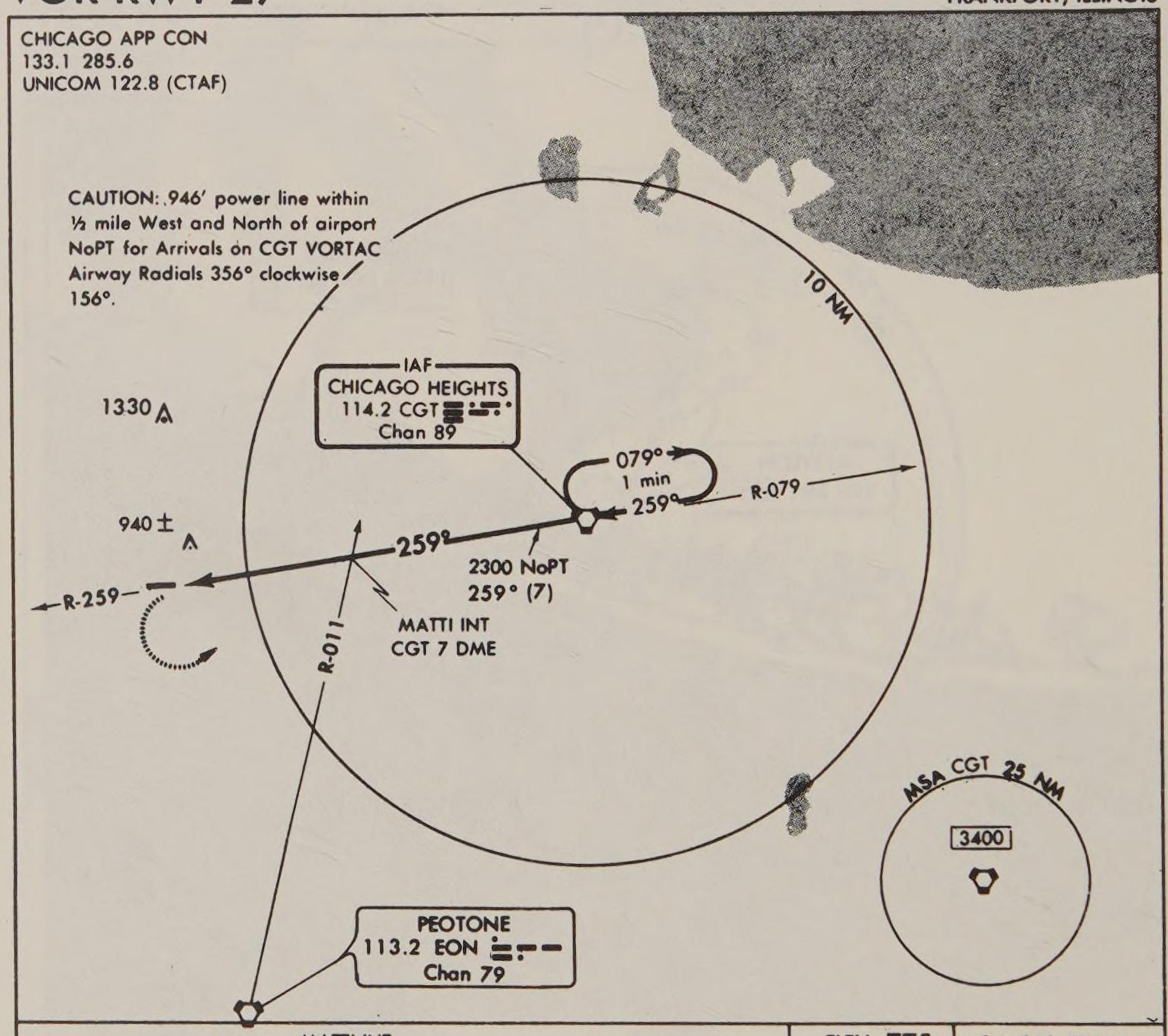
FARMINGDALE, NEW YORK
FARMINGDALE/REPUBLIC (FRG)

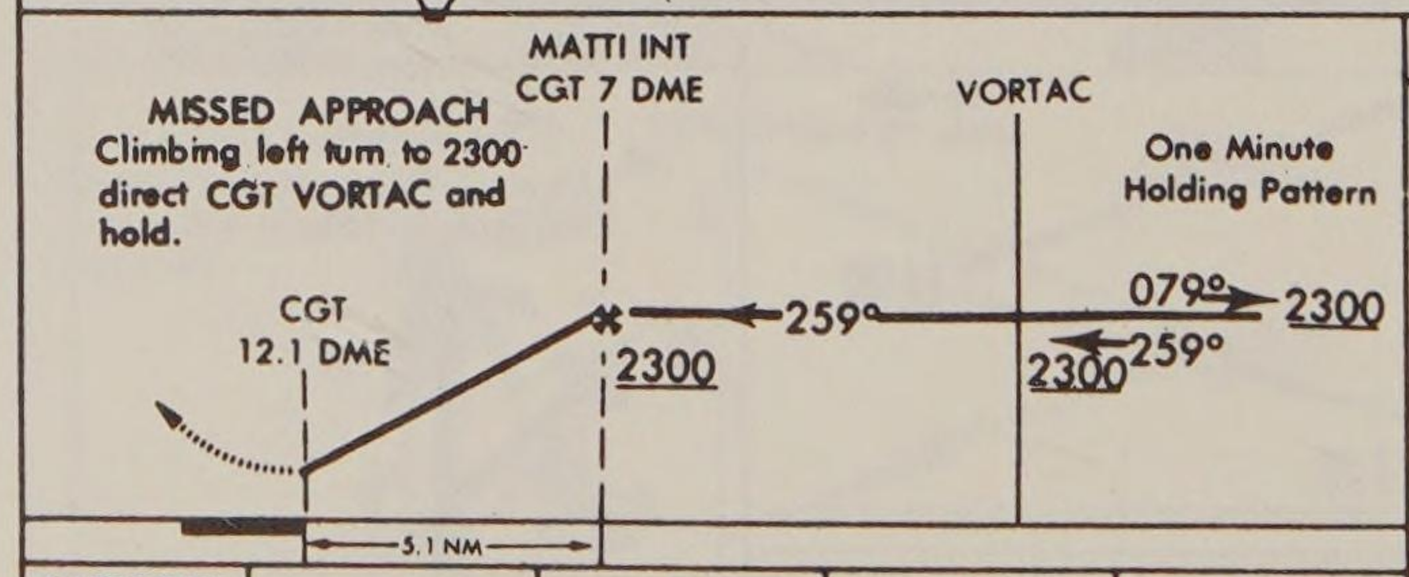
Not for use in Navigation

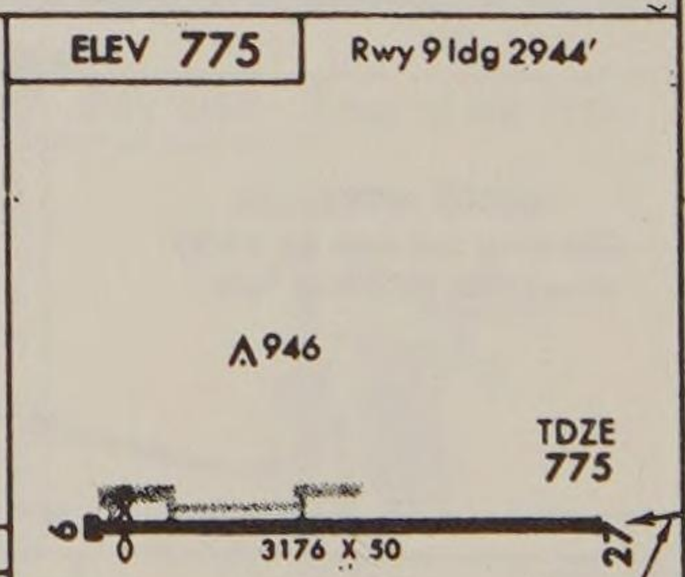
Amdt 3

VOR RWY 27

FRANKFORT (C18)
FRANKFORT, ILLINOIS







CATEGORY	A	B	C	D
S-27	1260-1 485 (500-1)		1260-1¼ 485 (500-1¼)	NA
CIRCLING	1320-1 545 (600-1)		1320-1½ 545 (600-1½)	NA

Use Chicago, Midway Airport, altimeter setting.

T
A NA

LIRL Rwy 9-27

FAF to MAP 5.1 NM					
Knots	60	90	120	150	180
Min:Sec	5:06	3:24	2:33	2:02	1:42

VOR RWY 27

41° 29'N-87° 51'W

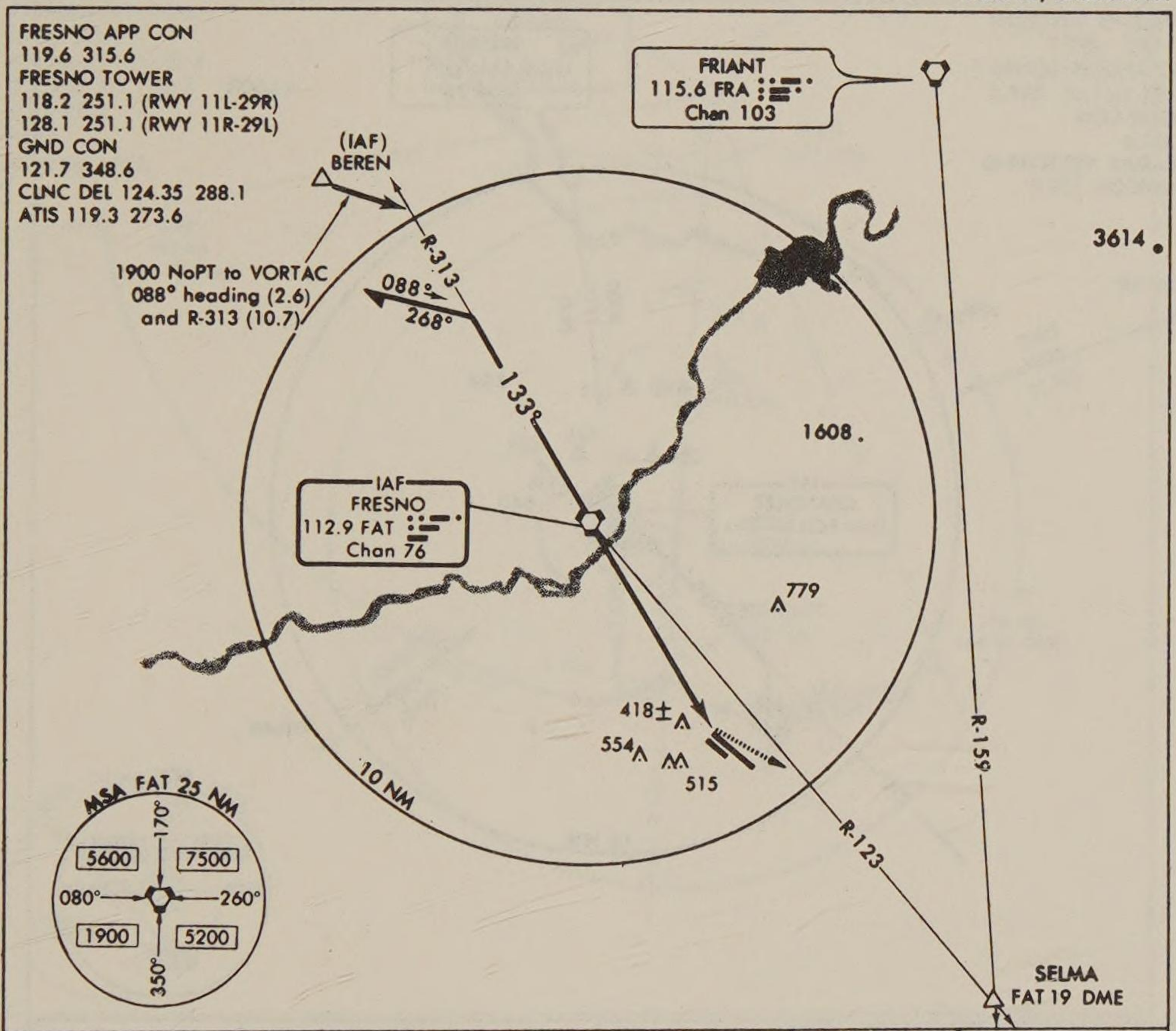
FRANKFORT, ILLINOIS
FRANKFORT (C18)

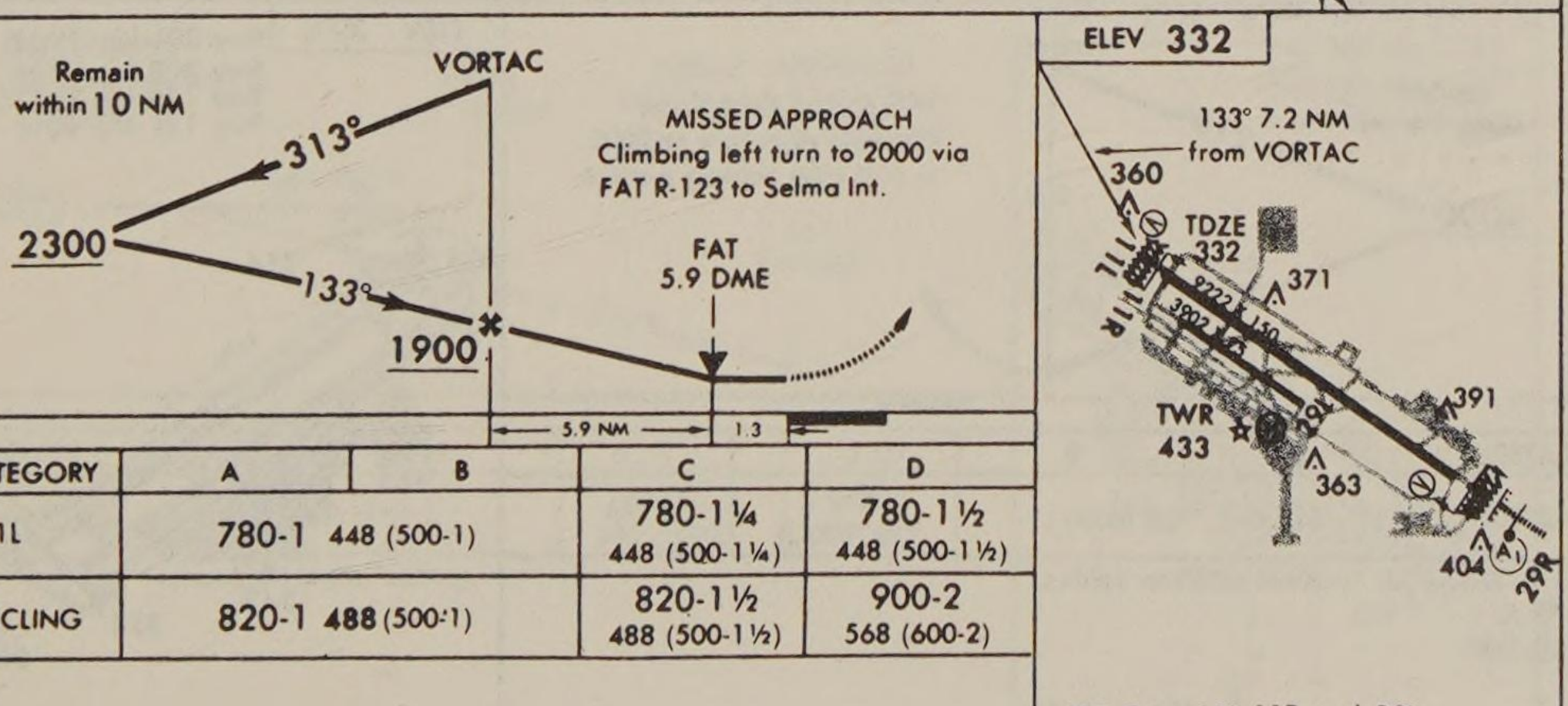
Not for use in Navigation

Amdt 7

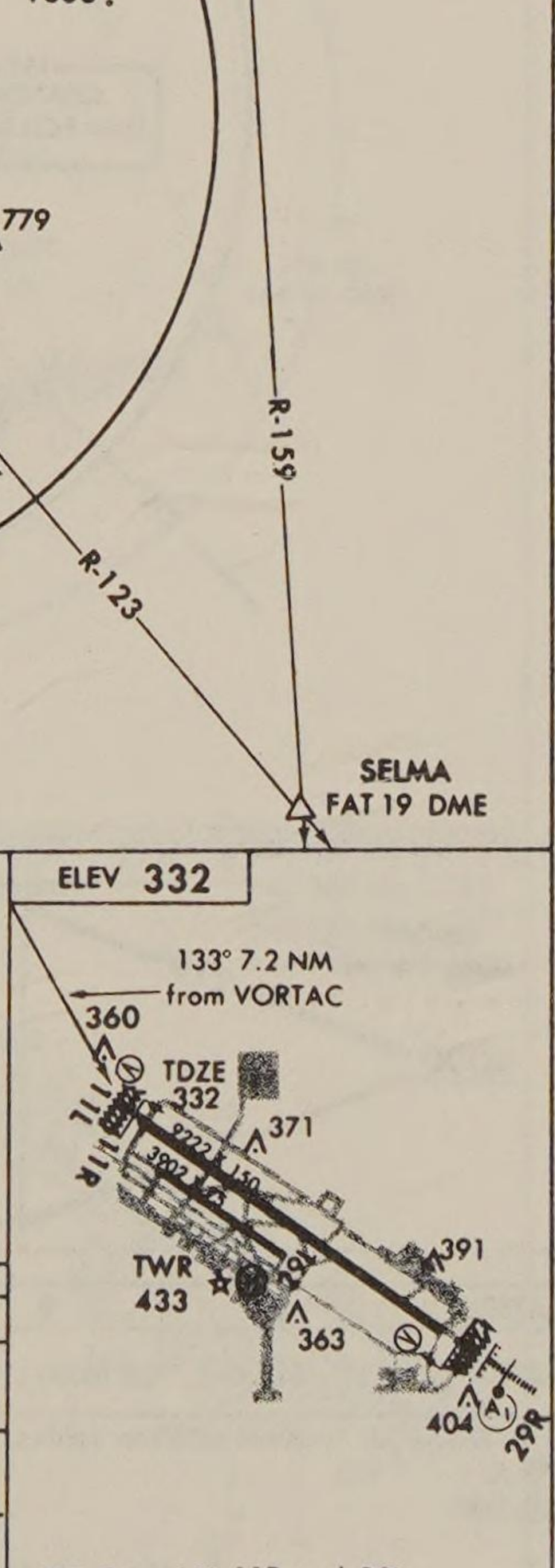
VOR RWY 11L

FRESNO AIR TERMINAL (FAT)
FRESNO, CALIFORNIA





CATEGORY	A	B	C	D
S-11L	780-1 448 (500-1)		780-1¼ 448 (500-1¼)	780-1½ 448 (500-1½)
CIRCLING	820-1 488 (500-1)		820-1½ 488 (500-1½)	900-2 568 (600-2)



REIL Rwys 11L, 11R and 29L
HIRL Rwy 11L-29R
MIRL Rwy 11R-29L

FAF to MAP 7.2 NM					
Knots	60	90	120	150	180
Min:Sec	7:12	4:48	3:36	2:53	2:24

VOR RWY 11L

36°46'N-119°43'W

FRESNO, CALIFORNIA
FRESNO AIR TERMINAL (FAT)

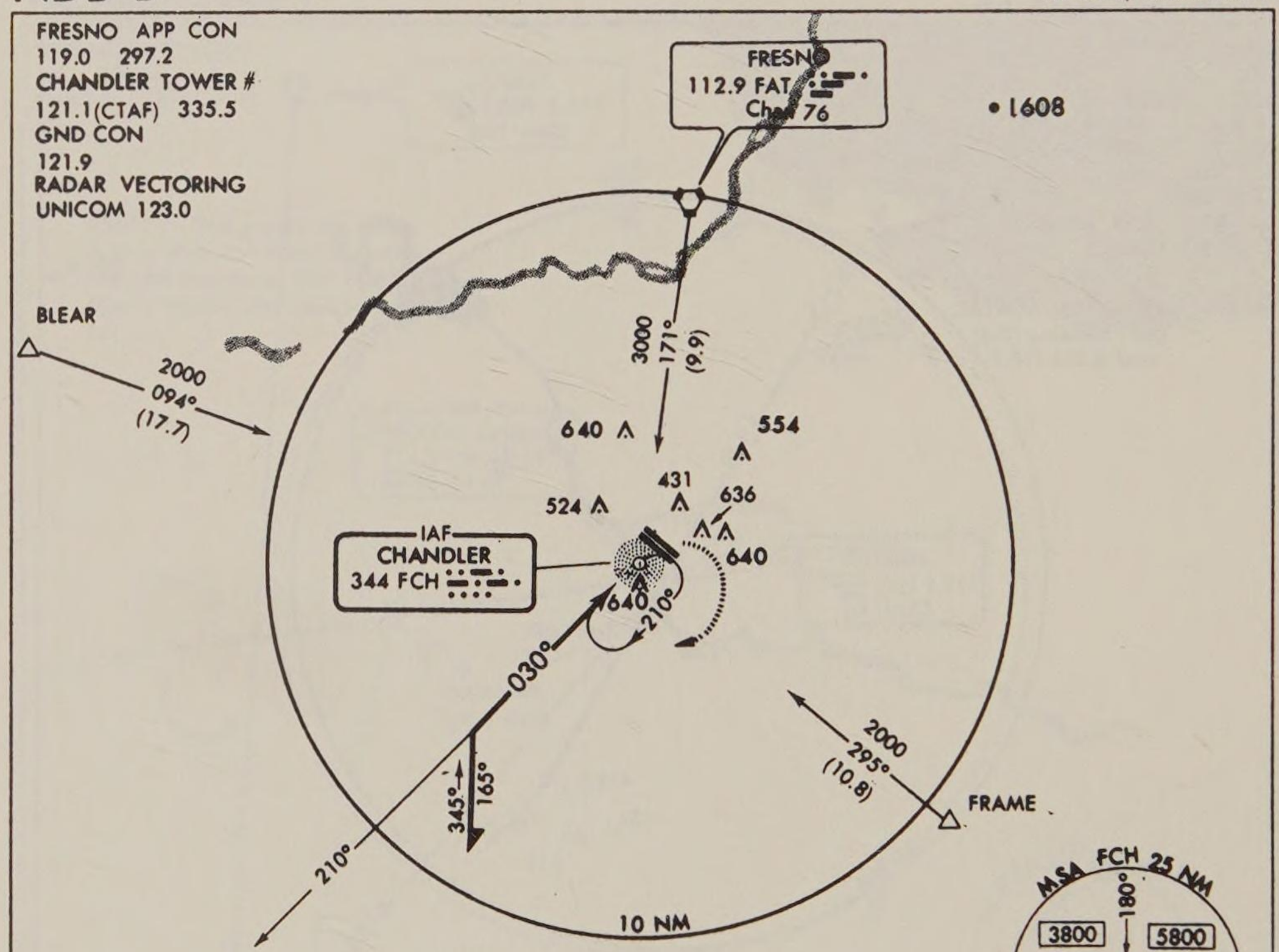
Not for use in Navigation

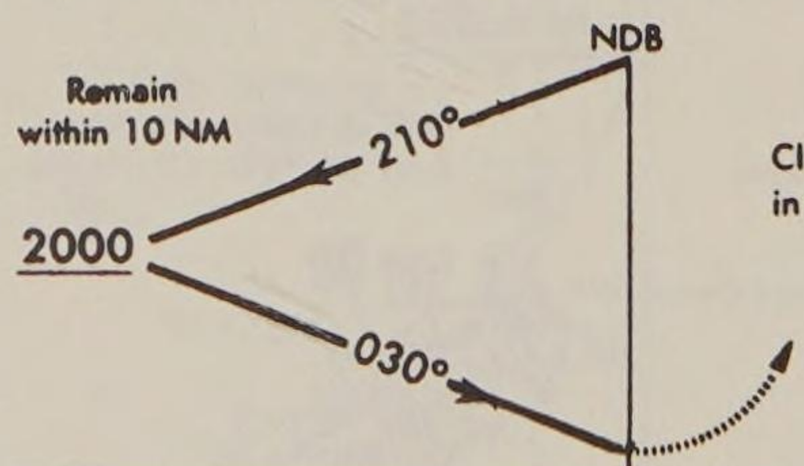
Amdt 4

NDB-B

FRESNO-CHANDLER DOWNTOWN (FCH)

FRESNO, CALIFORNIA

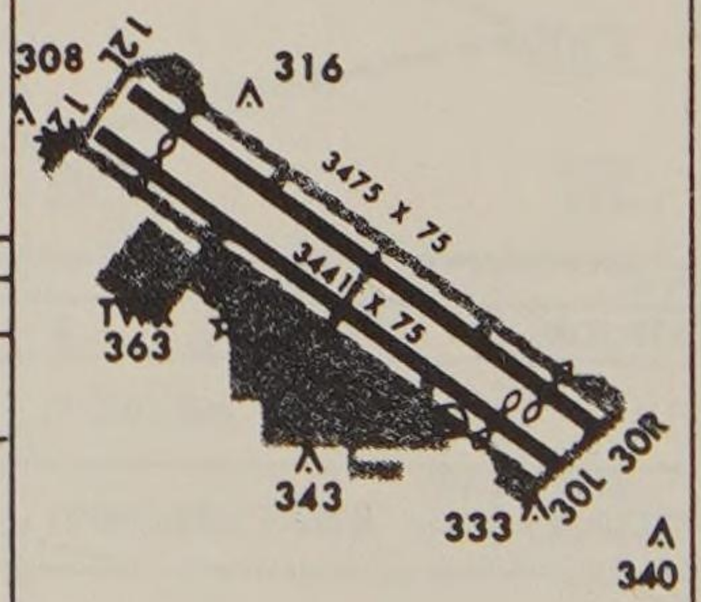




MISSED APPROACH
Climbing right turn to 2000
in FCH NDB holding pattern.

ELEV 278

Rwy 30L ldg 2902'
Rwy 30R ldg 2964'
Rwy 12R ldg 2977'
Rwy 12L ldg 3012'



REIL Rwys 12R and 30L
MIRL Rwy 12R-30L

CATEGORY	A	B	C	D
CIRCLING	1000-1 722 (800-1)		1000-2 722 (800-2)	NA

Use Fresno Air Terminal altimeter setting.

▼T
▲A NA

Knots	60	90	120	150	180
Min:Sec					

NDB-B

36°44'N-119°49'W

FRESNO, CALIFORNIA

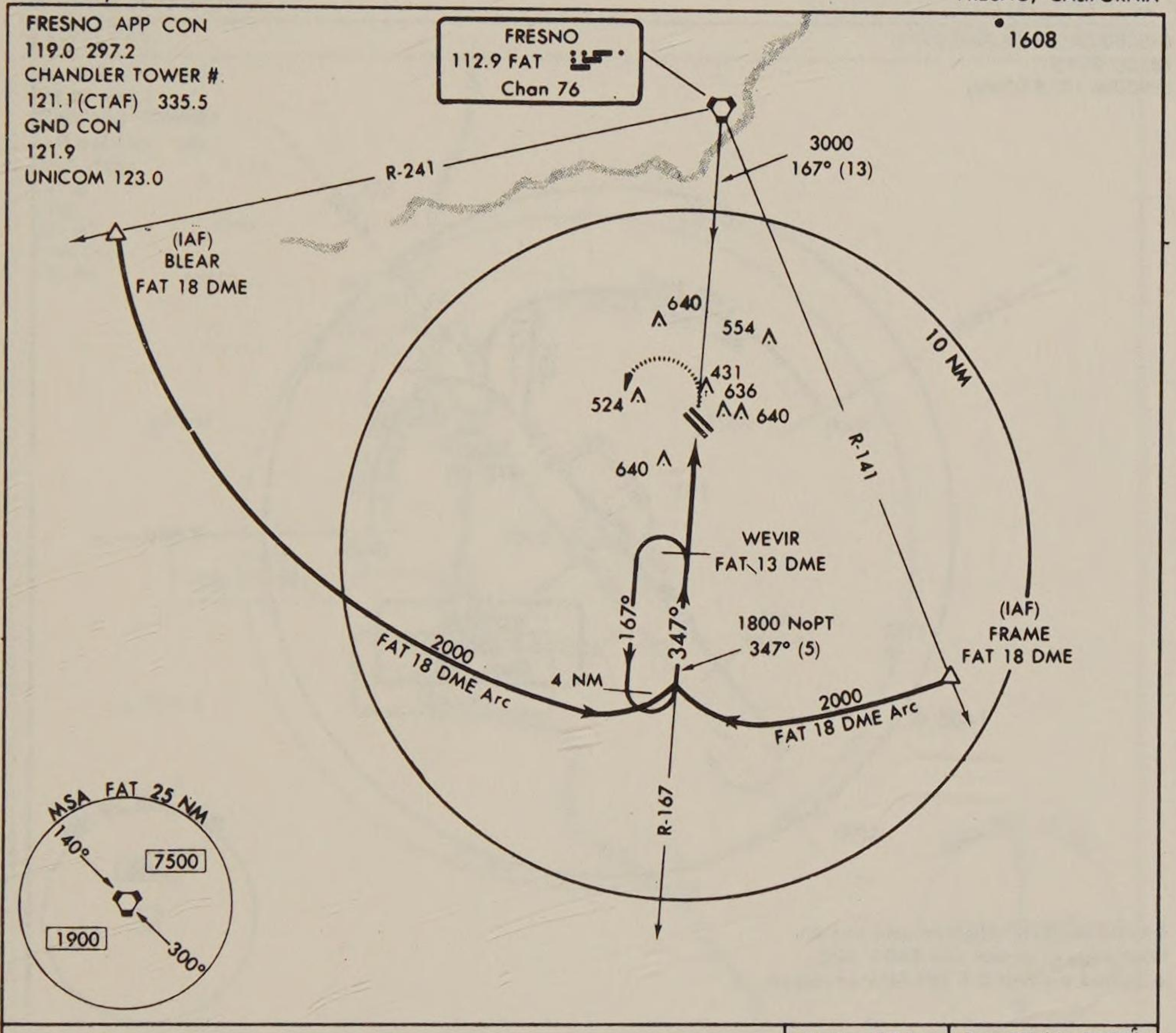
FRESNO-CHANDLER DOWNTOWN (FCH)

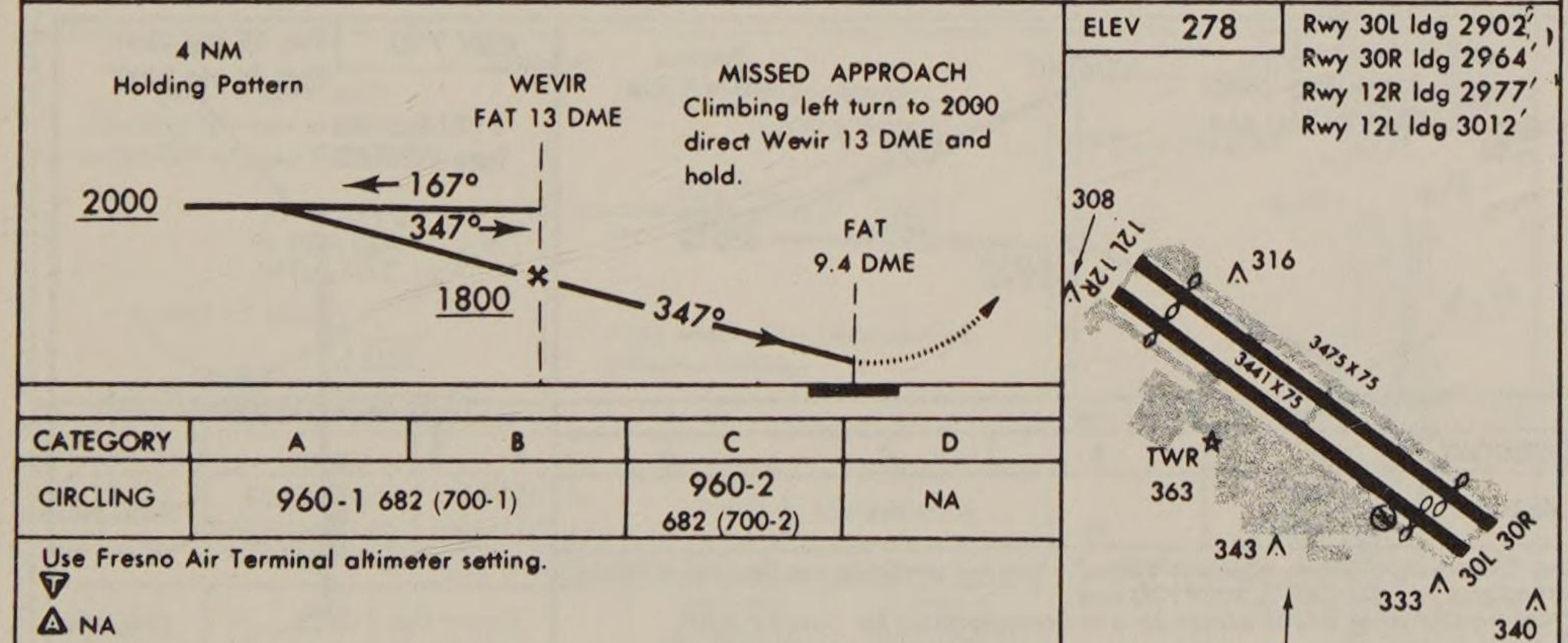
Not for use in Navigation

Orig

VOR/DME-C

FRESNO-CHANDLER DOWNTOWN (FCH)
FRESNO, CALIFORNIA





CATEGORY	A	B	C	D
CIRCLING	960-1 682 (700-1)		960-2 682 (700-2)	NA

Use Fresno Air Terminal altimeter setting.

▼

▲ NA

ELEV 278

Rwy 30L ldg 2902′
Rwy 30R ldg 2964′
Rwy 12R ldg 2977′
Rwy 12L ldg 3012′

REIL Rwys 12R and 30L
MIRL Rwy 12R-30L

Knots	60	90	120	150	180
Min:Sec					

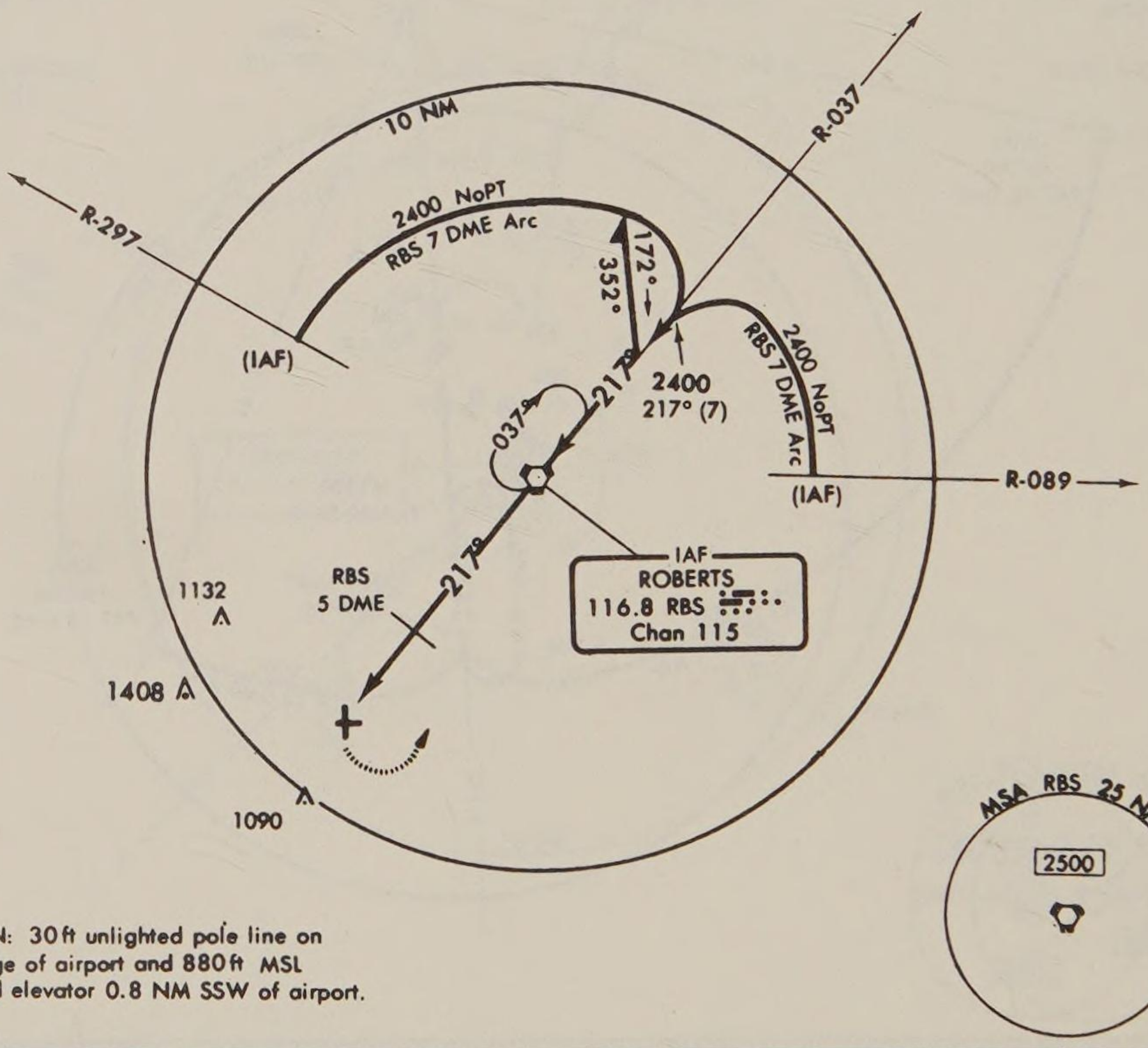
Not for use in Navigation

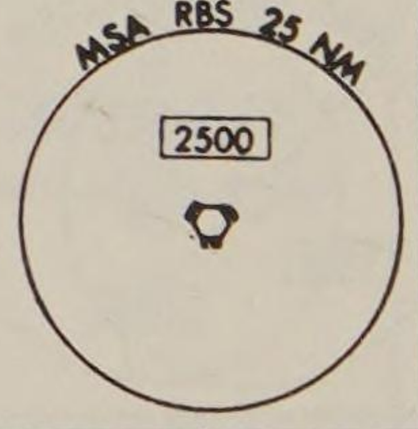
Amdt 3

VOR-A

GIBSON CITY MUNI (C34)
GIBSON CITY, ILLINOIS

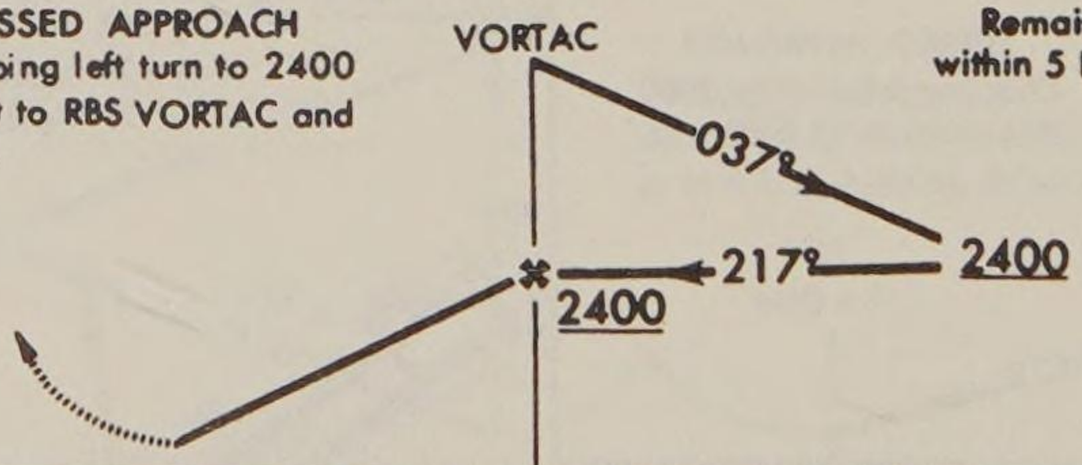
CHICAGO CENTER
127.45 397.9
UNICOM 122.8 (CTAF)





CAUTION: 30ft unlighted pole line on West edge of airport and 880ft MSL unlighted elevator 0.8 NM SSW of airport.

MISSED APPROACH
Climbing left turn to 2400 direct to RBS VORTAC and hold.

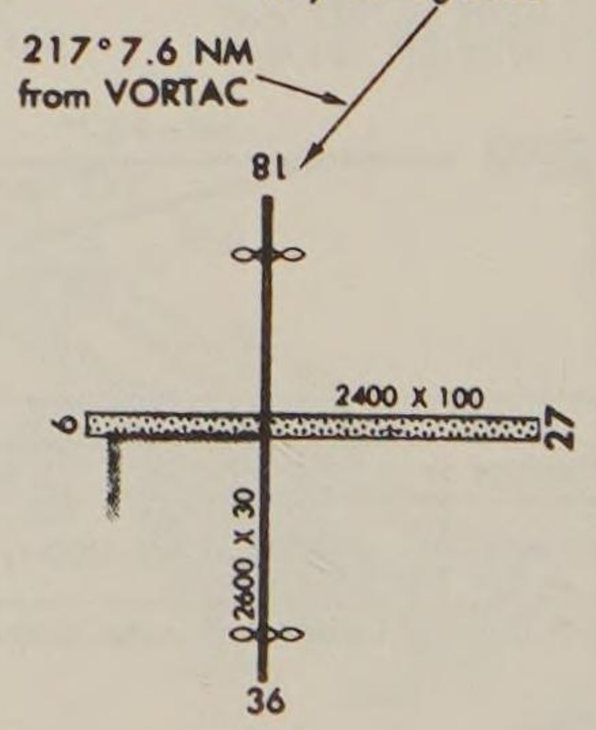


CATEGORY	A	B	C	D
CIRCLING	1340-1 , 581 (600-1),	NA		

Use Champaign, Illinois altimeter setting, when not available use Decatur altimeter setting and increase Cat. A MDA 120 feet.
Procedure NA after 0430Z except by prior arrangement for runway lights.
⚠ NA

ELEV 750

Rwy 18 ldg 2240'
Rwy 36 ldg 2400'



LIRL Rwy 18-36

FAF to MAP 7.6 NM					
Knots	60	90	120	150	180
Min:Sec	7:36	5:04	3:48	3:02	2:32

VOR-A

40°29'N – 88°16'W

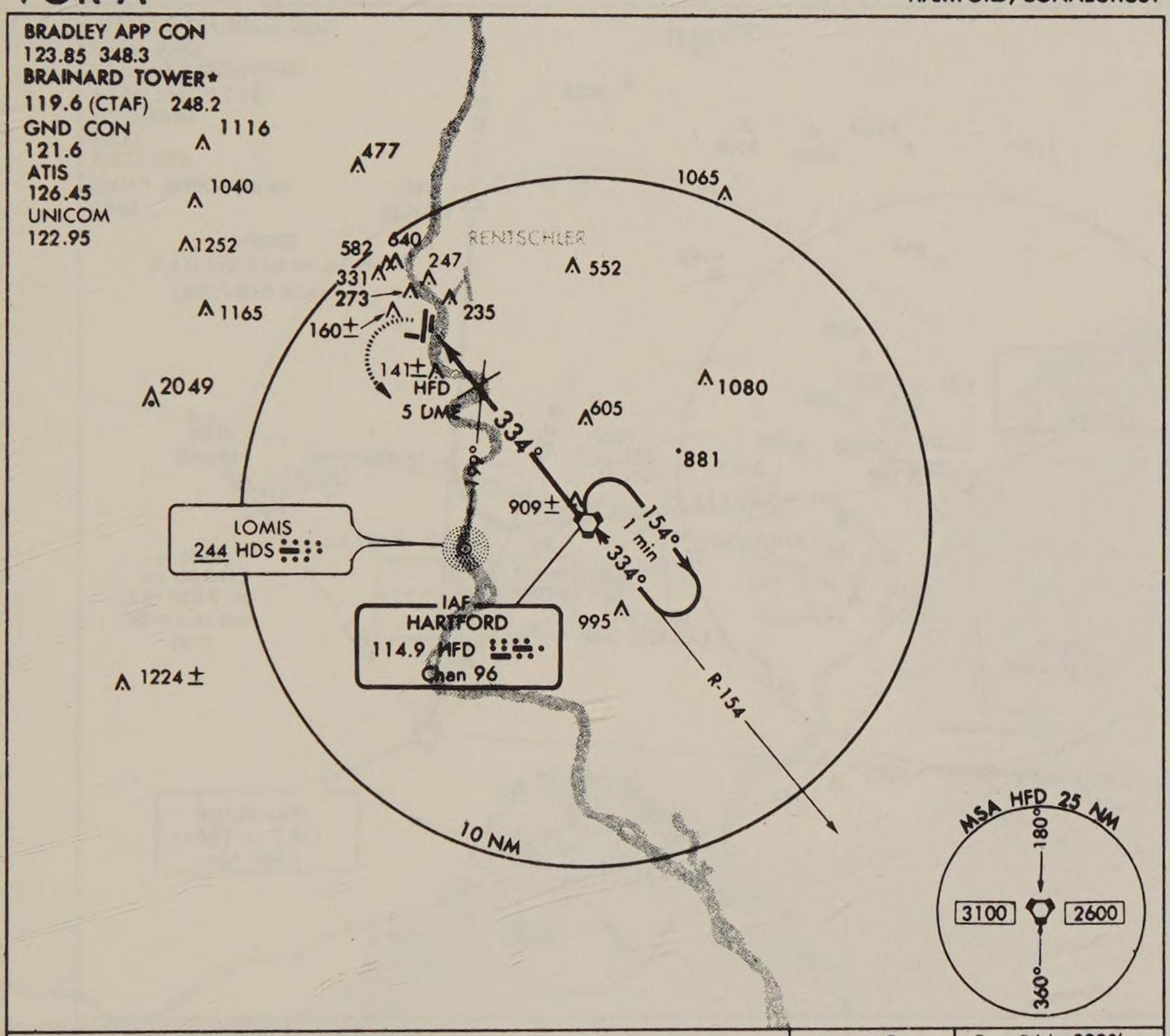
GIBSON CITY, ILLINOIS
GIBSON CITY MUNI (C34)

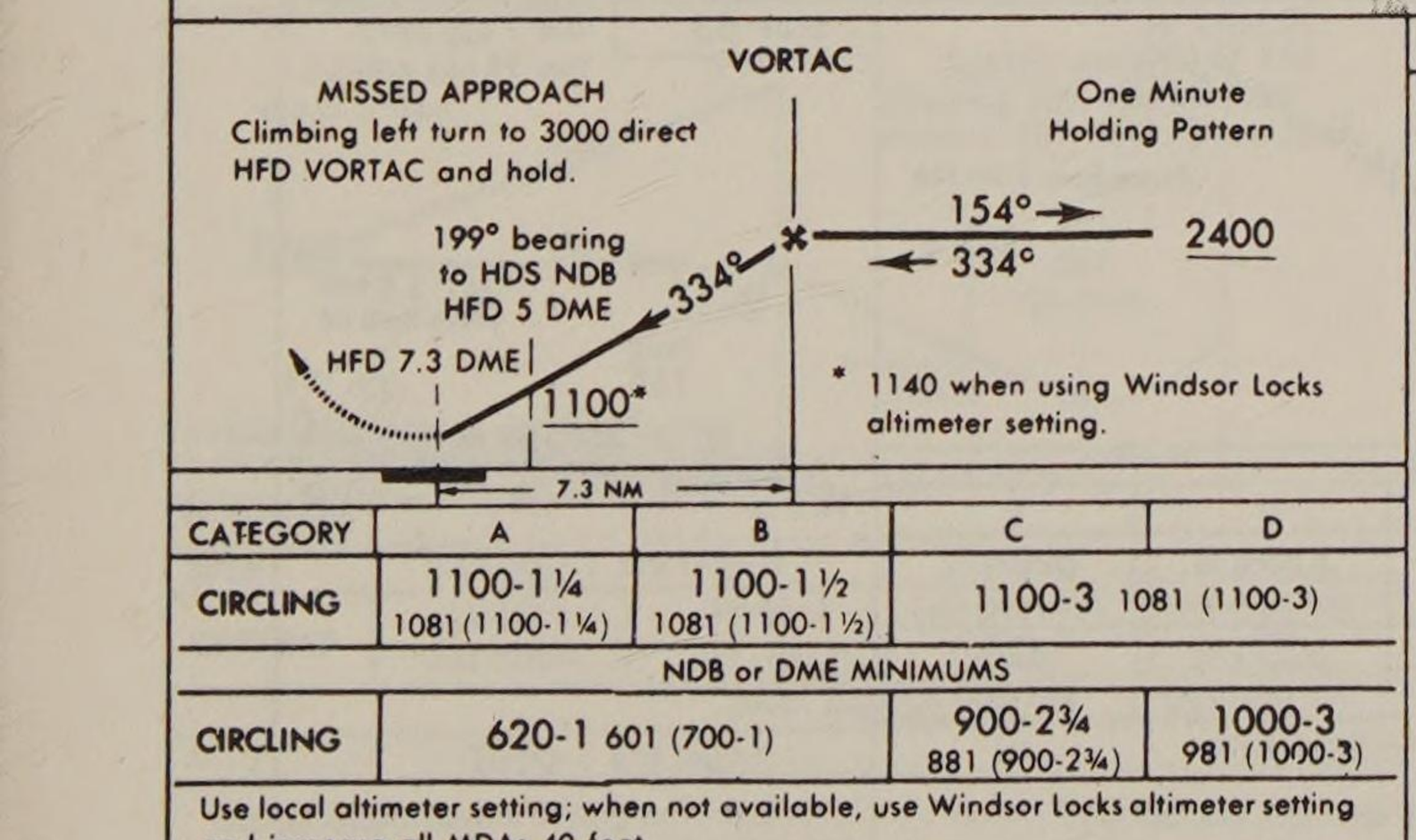
Not for use in Navigation

Amdt 8

VOR-A

HARTFORD-BRAINARD (HFD)
HARTFORD, CONNECTICUT





CATEGORY	A	B	C	D
CIRCLING	1100-1¼ 1081 (1100-1¼)	1100-1½ 1081 (1100-1½)	1100-3 1081 (1100-3)	
NDB or DME MINIMUMS				
CIRCLING	620-1 601 (700-1)		900-2¾ 881 (900-2¾)	1000-3 981 (1000-3)

Use local altimeter setting; when not available, use Windsor Locks altimeter setting and increase all MDAs 40 feet.

T
A NA

ELEV 19

Rwy 2 ldg 3990'
Rwy 20 ldg 3859'
Rwy 29 ldg 2048'

MIRL Rwys 11-29 and 2-20

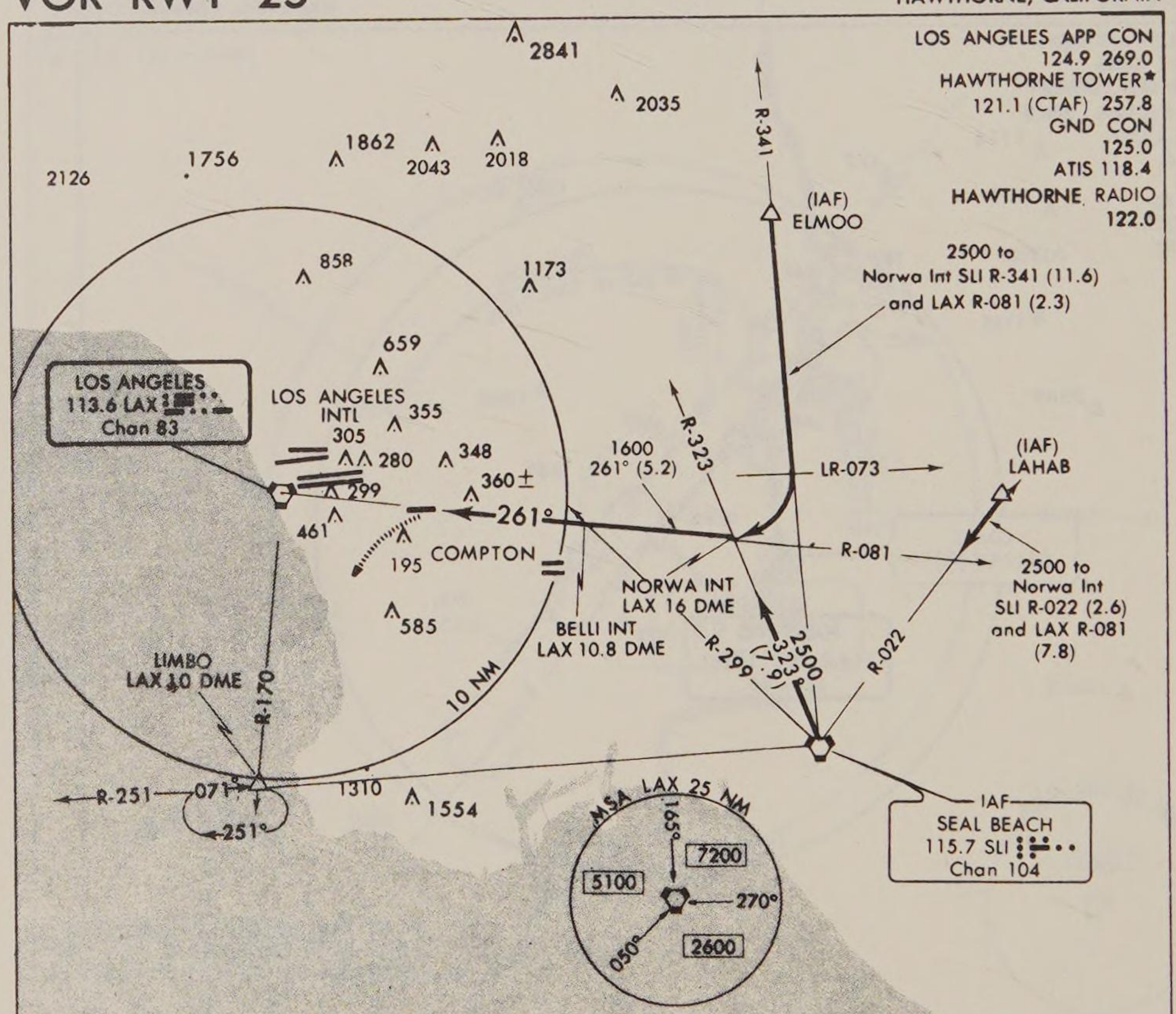
FAF to MAP 7.3 NM					
Knots	60	90	120	150	180
Min:Sec	7:18	4:52	3:39	2:55	2:26

Not for use in Navigation

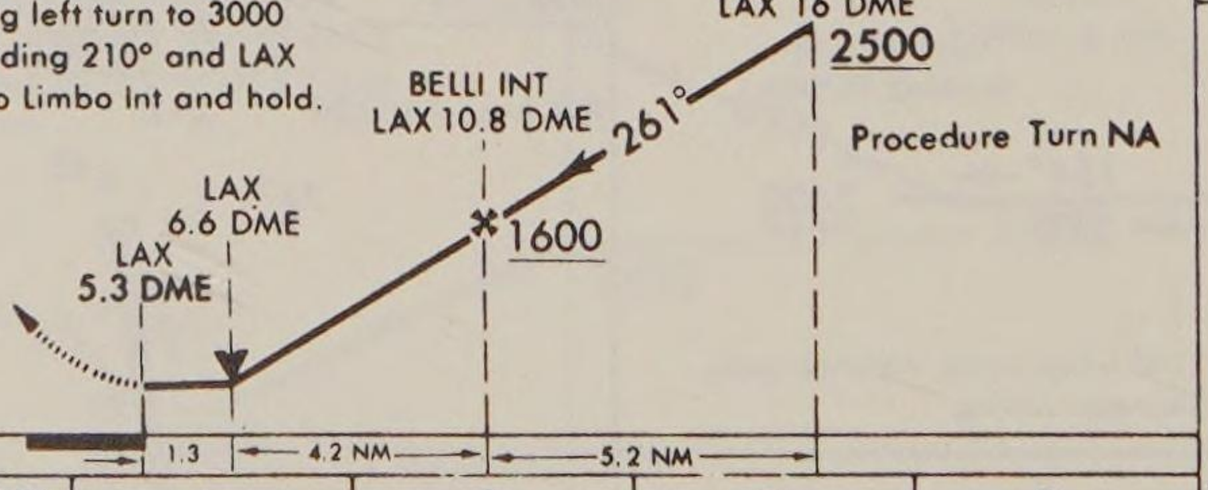
Amdt 13

VOR RWY 25

HAWTHORNE MUNI (HHR)
HAWTHORNE, CALIFORNIA

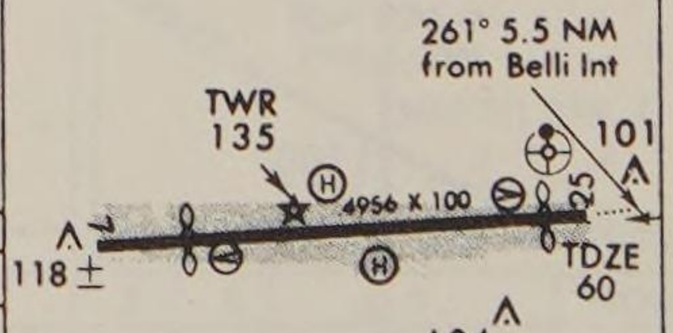


MISSED APPROACH
Climbing left turn to 3000 via heading 210° and LAX R-170 to Limbo Int and hold.



ELEV 63

Rwy 7 ldg 3975'
Rwy 25 ldg 4483'



MIRL Rwy 7-25

CATEGORY	A	B	C	D
S-25	620-1 560 (600-1)		620-1½ 560 (600-1½)	620-1¾ 560 (600-1¾)
CIRCLING	620-1 557 (600-1)		620-1½ 557 (600-1½)	620-2 557 (600-2)

When control tower closed use Los Angeles altimeter setting.
Circling not authorized north of Rwy 7-25.
ACTIVATE MIRL Rwy 7-25, VASI Rwys 7 and 25 and REIL Rwy 25-121.1.

FAF to MAP 5.5 NM					
Knots	60	90	120	150	180
Min:Sec	5:30	3:40	2:45	2:12	1:50

VOR RWY 25

33°55'N – 118° 20'W

HAWTHORNE, CALIFORNIA
HAWTHORNE MUNI (HHR)

Not for use in Navigation

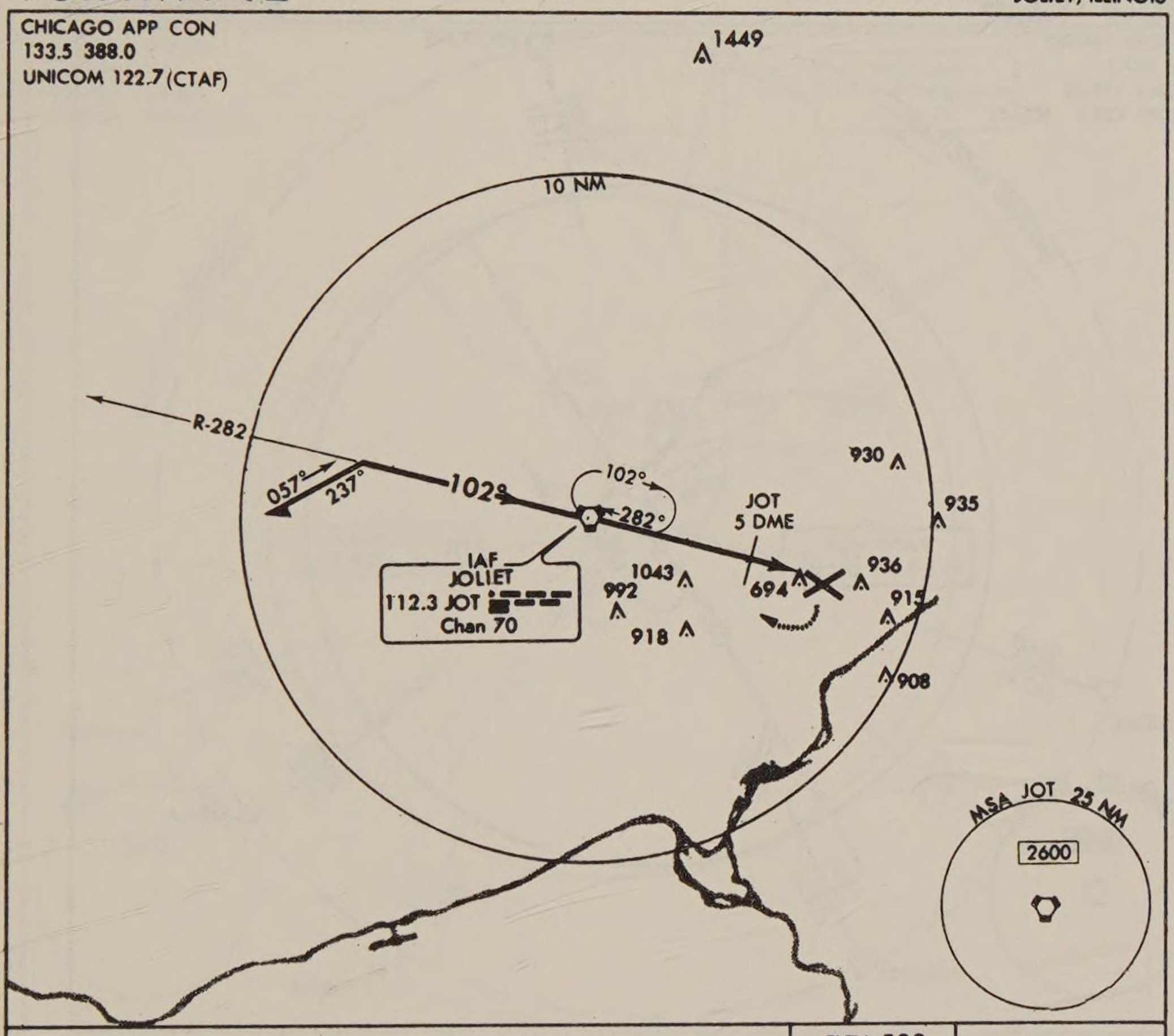
Amdt 9

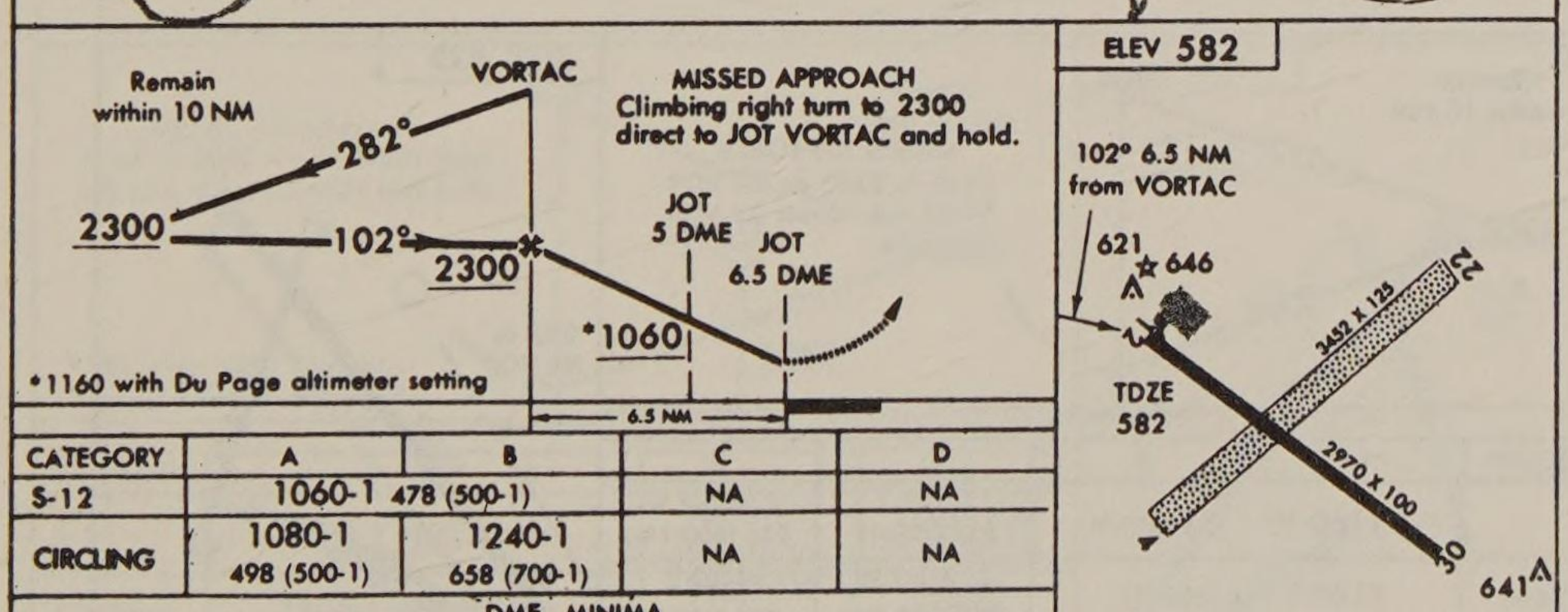
VOR RWY 12

JOLIET PARK DISTRICT (JOT)
JOLIET, ILLINOIS

CHICAGO APP CON
133.5 388.0
UNICOM 122.7 (CTAF)

1449





CATEGORY	A	B	C	D
S-12	1060-1 478 (500-1)		NA	NA
CIRCLING	1080-1 498 (500-1)	1240-1 658 (700-1)	NA	NA
DME MINIMA				
S-12	1000-1 418 (500-1)		NA	NA

Obtain local altimeter setting on UNICOM 122.7; when not available, use Du Page altimeter setting and increase all MDAs 100 feet.

T
A

ELEV 582

REIL Rwy 12
MIRL Rwy 12-30

FAF to MAP 6.5 NM					
Knots	60	90	120	150	180
Min:Sec	6:30	4:20	3:15	2:36	2:10

VOR RWY 12

41°31'N-88°10'W

JOLIET, ILLINOIS
JOLIET PARK DISTRICT (JOT)

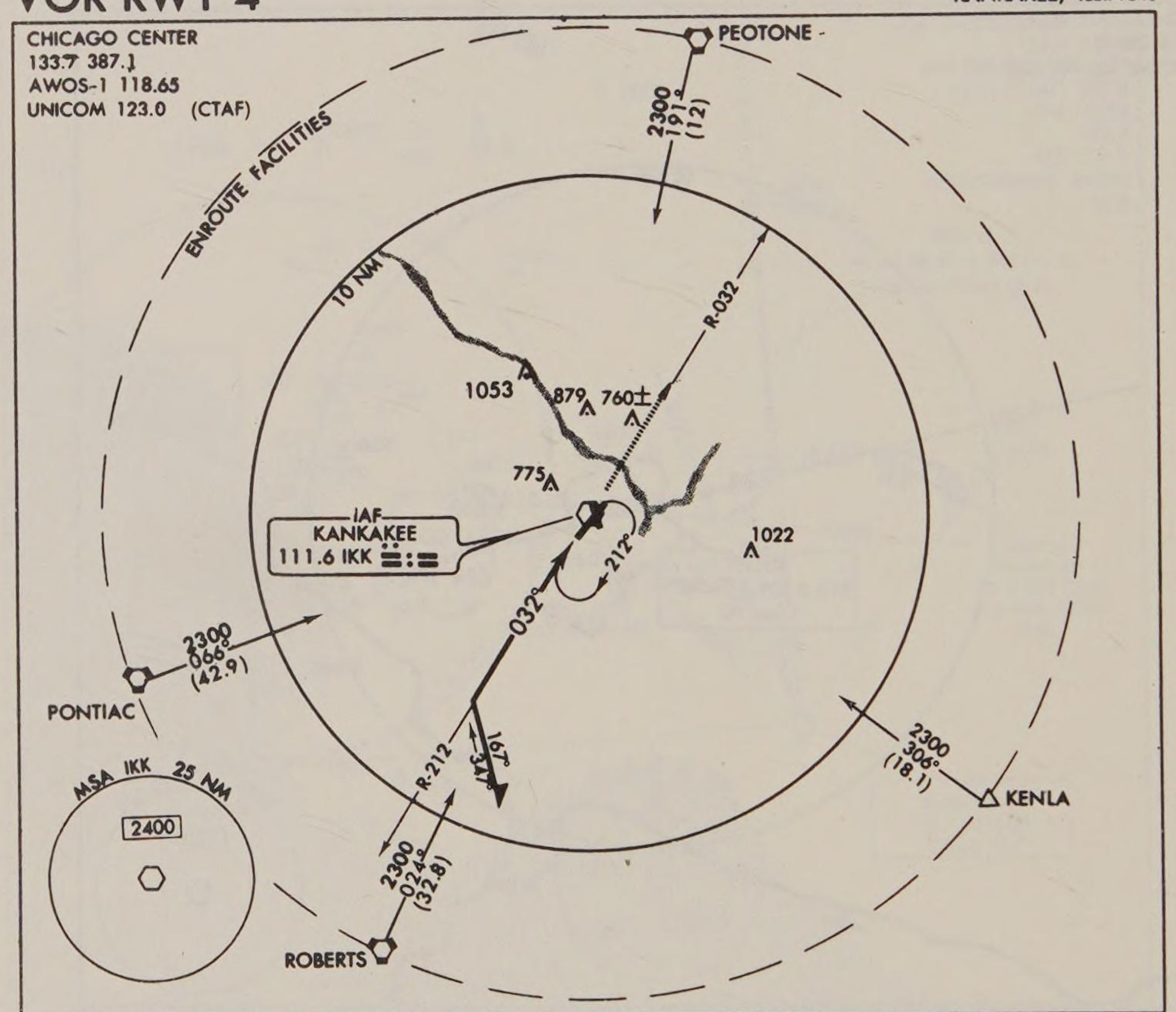
Not for use in Navigation

Amdt 3

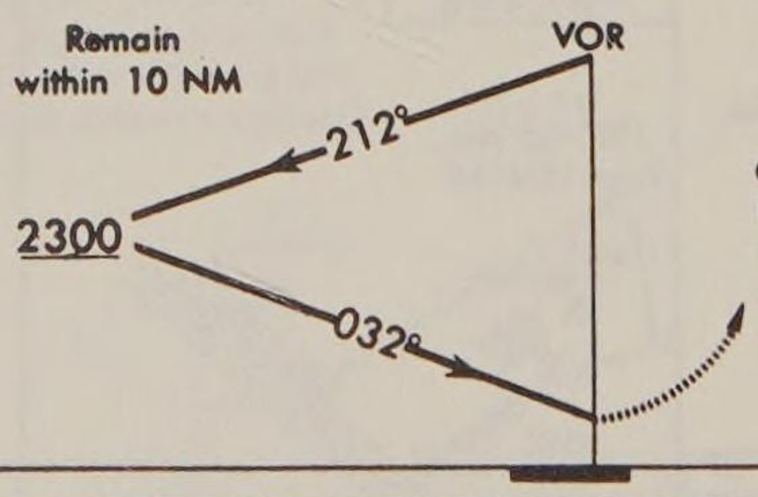
VOR RWY 4

KANKAKEE/GREATER KANKAKEE (IKK)
KANKAKEE, ILLINOIS

CHICAGO CENTER
133.7 387.1
AWOS-1 118.65
UNICOM 123.0 (CTAF)

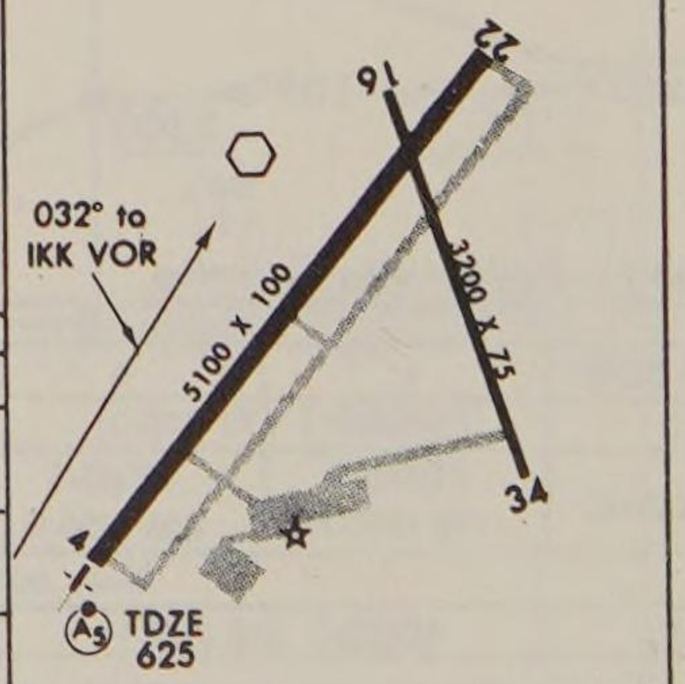


Remain within 10 NM



MISSED APPROACH
Climb to 2300 via IKK VOR R-032, then direct IKK VOR and hold.

ELEV 625



MIRL Rwys 4-22 and 16-34

CATEGORY	A	B	C	D
S-4	1160-½ 535 (600-½)		1160-1 535 (600-1)	1160-1¼ 535 (600-1¼)
CIRCLING	1160-1 535 (600-1)		1160-1½ 535 (600-1½)	1180-2 555 (600-2)

Obtain Greater Kankakee altimeter setting on UNICOM 123.0; when not available, except for operators with approved weather reporting service: 1. Use Chicago Midway altimeter setting. 2. Increase all MDAs 200 feet. 3. Alternate minimums not authorized.
ACTIVATE MALSR Rwy 4-123.0.

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 4

41°04'N – 87°51'W

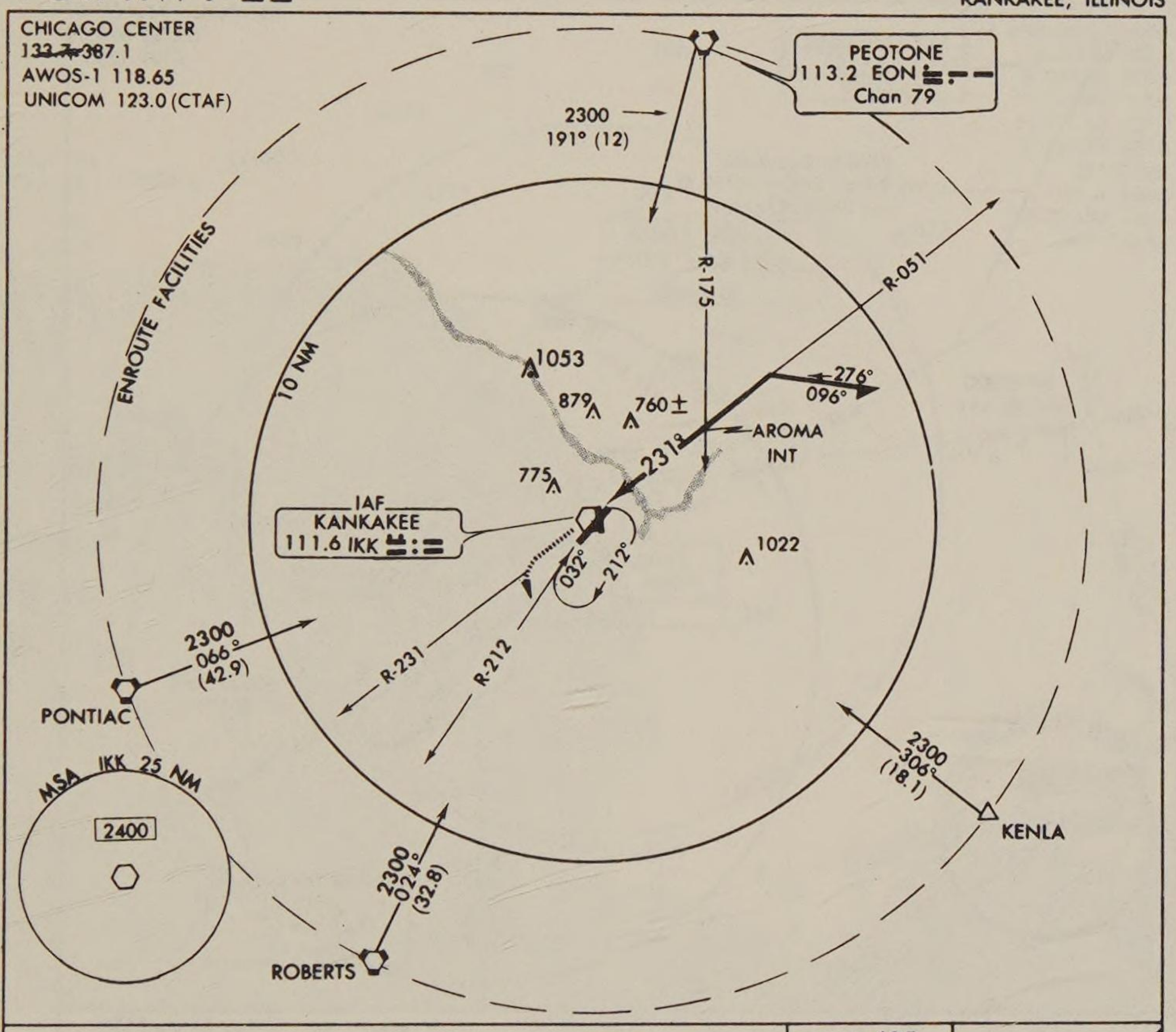
KANKAKEE, ILLINOIS
KANKAKEE/GREATER KANKAKEE (IKK)

Not for use in Navigation

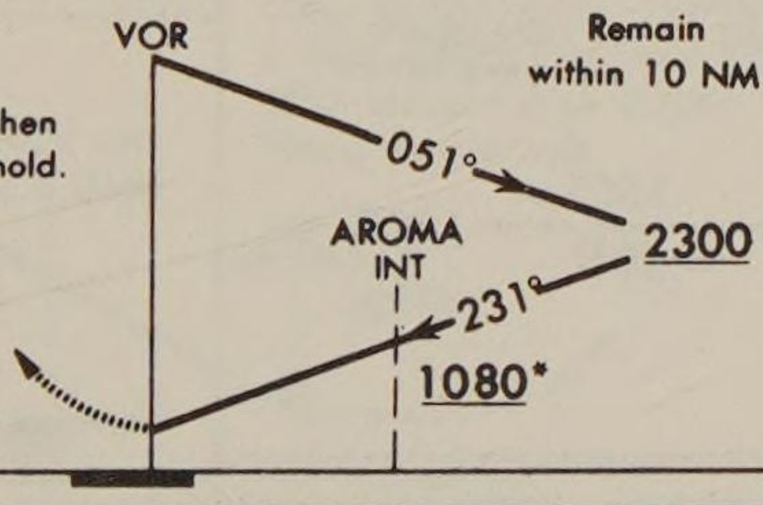
Amdt 4

VOR RWY 22

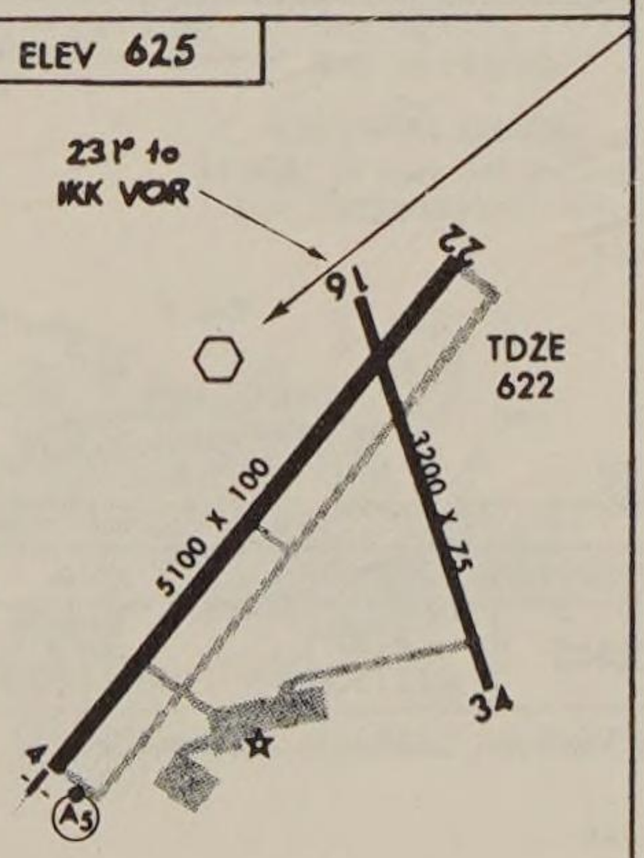
KANKAKEE/GREATER KANKAKEE(IKK)
KANKAKEE, ILLINOIS



MISSED APPROACH
Climb to 2300 via IKK R-231 then left turn direct IKK VOR and hold.



*1280 when using Chicago Midway altimeter setting.



CATEGORY	A	B	C	D
S- 22	1080-1 458 (500-1)		1080-1¼ 458 (500-1¼)	1080-1½ 458 (500-1½)
CIRCLING	1100-1 475 (500-1)		1100-1½ 475 (500-1½)	1180-2 555 (600-2)
DUAL VOR MINIMA				
S- 22	1020-1 398 (400-1)		1020-1¼ 398 (400-1¼)	

Obtain local altimeter setting on UNICOM 123.0; when not available, except for operators with approved weather reporting service: 1. Use Chicago Midway altimeter setting. 2. Increase all MDAs 200 feet. 3. Alternate minimums not authorized. ACTIVATE MALSR Rwy 4-123.0. ▽△

MIRL Rwys 4-22 and 16-34

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 22

41°04'N – 87°51'W

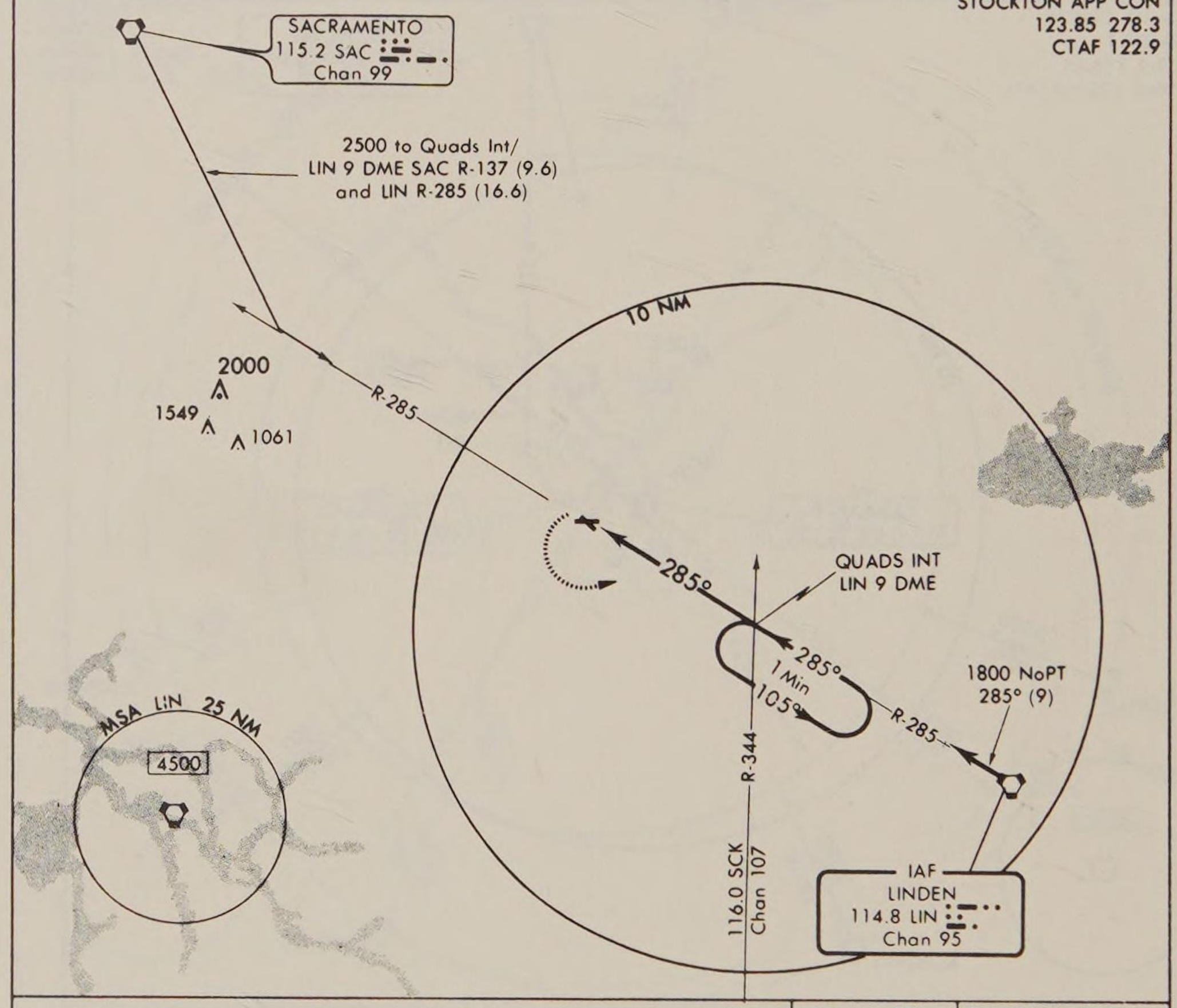
KANKAKEE, ILLINOIS
KANKAKEE/GREATER KANKAKEE(IKK)

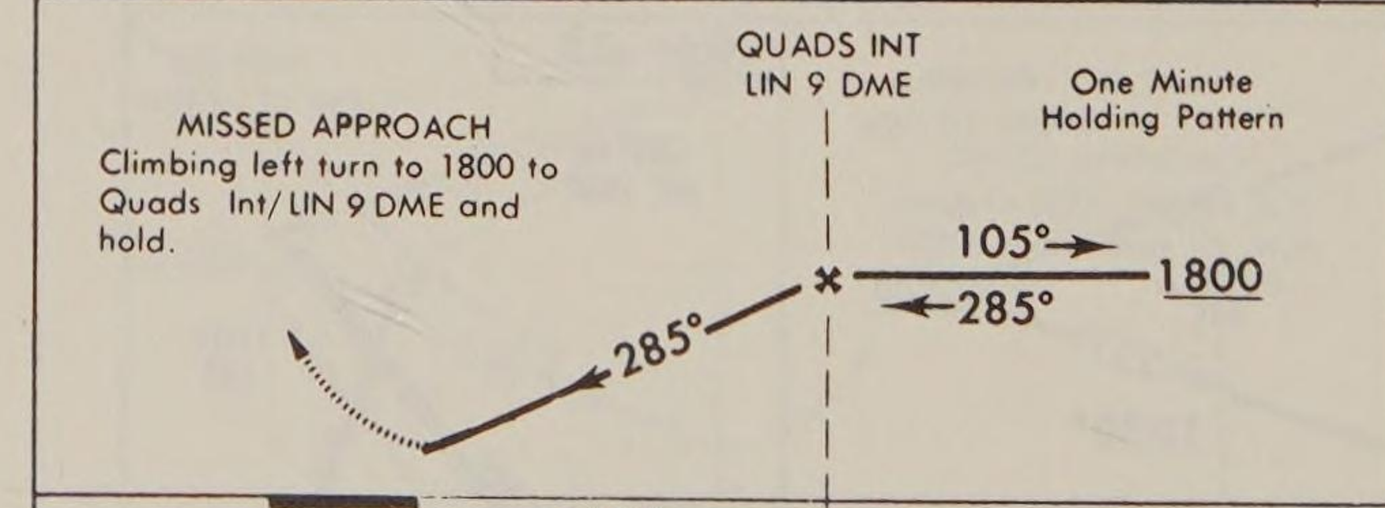
Not for use in Navigation

Amdt 1
VOR-A

LODI (103)
LODI, CALIFORNIA

STOCKTON APP CON
123.85 278.3
CTAF 122.9





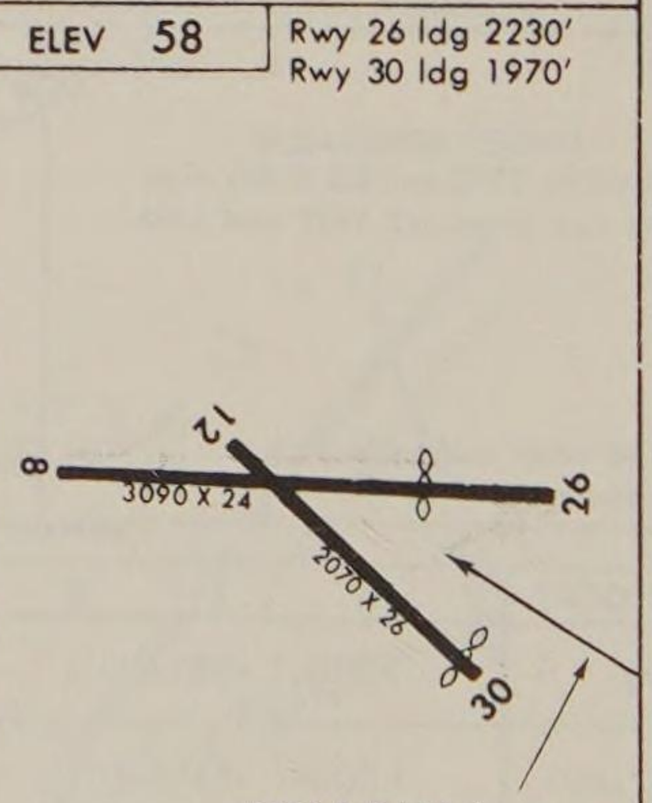
CATEGORY	A	B	C	D
CIRCLING	480-1 422 (500-1)	520-1 462 (500-1)	520-1½ 462(500-1½)	620-2 562 (600-2)

Use Stockton, California altimeter setting.

▽
△ NA

ELEV 58

Rwy 26 ldg 2230′
Rwy 30 ldg 1970′



LIRL Rwy 8-26

FAF to MAP 5.5 NM					
Knots	60	90	120	150	180
Min:Sec	5:30	3:40	2:45	2:12	1:50

VOR-A

38°12′N – 121°16′W

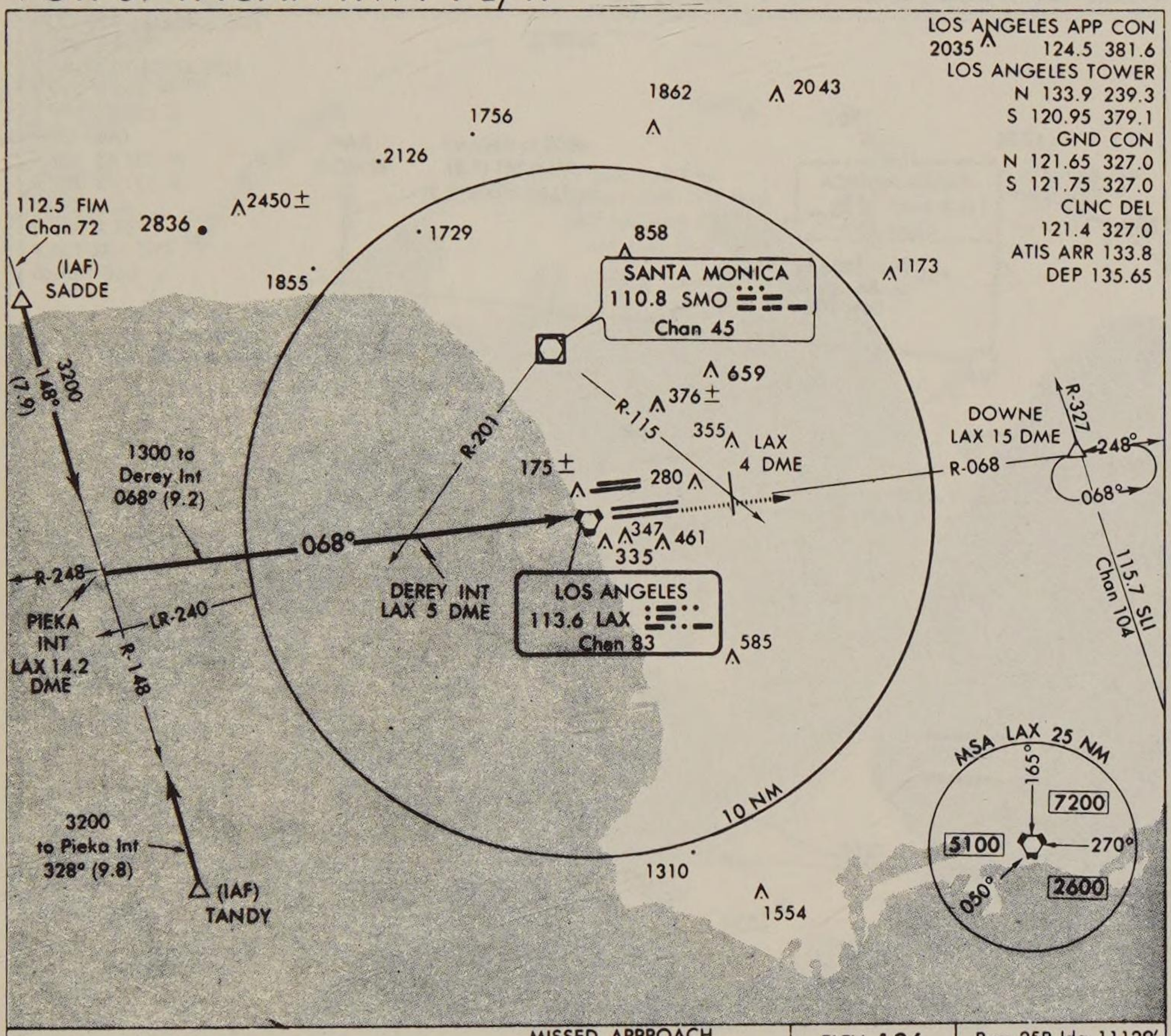
LODI, CALIFORNIA
LODI (103)

Not for use in Navigation

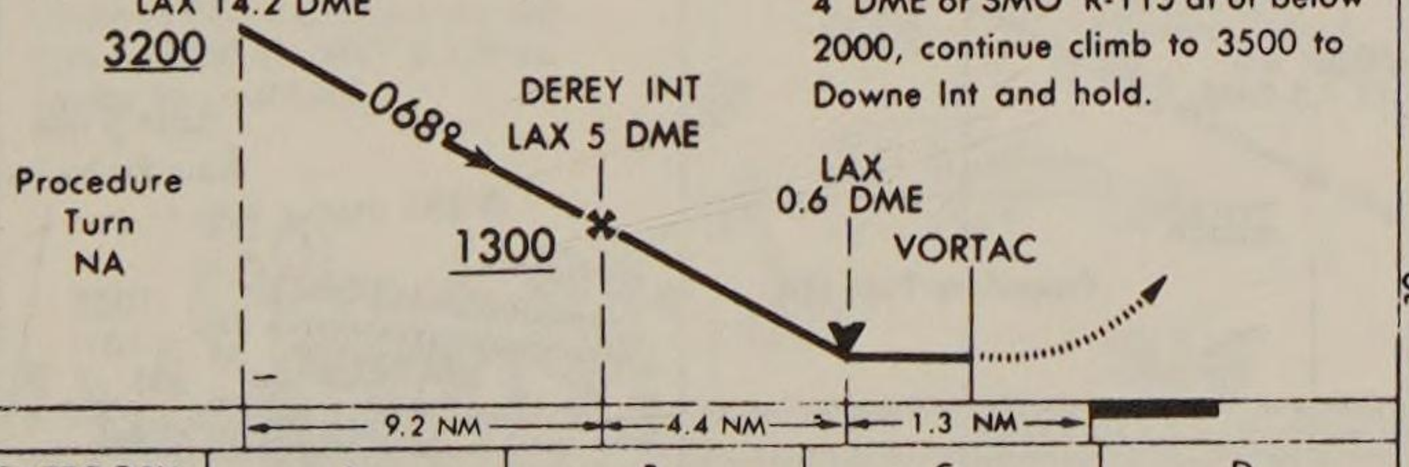
Amdt 17

VOR or TACAN RWY 7L/R

LOS ANGELES INTERNATIONAL (LAX)
LOS ANGELES, CALIFORNIA



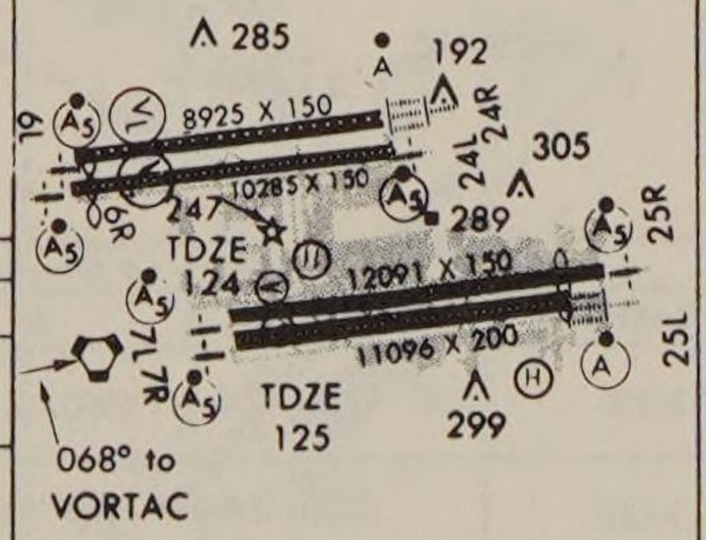
MISSED APPROACH
Climb via LAX R-068, cross LAX 4 DME or SMO R-115 at or below 2000, continue climb to 3500 to Downe Int and hold.



CATEGORY	A	B	C	D
S-7L	600/24 476 (500-½)		600/40 476 (500-¾)	600/50 476 (500-1)
S-7R	600/24 475 (500-½)		600/40 475 (500-¾)	600/50 475 (500-1)

ELEV 126

Rwy 25R ldg 11129'
Rwy 6R ldg 9964'



TDZ/CL Rwys 24R and 25L
HIRL Rwys 7R-25L, 7L-25R,
6R-24L and 6L-24R

Knots	60	90	120	150	180
Min:Sec					

VOR or TACAN RWY 7L/R

33°57'N – 118°24'W

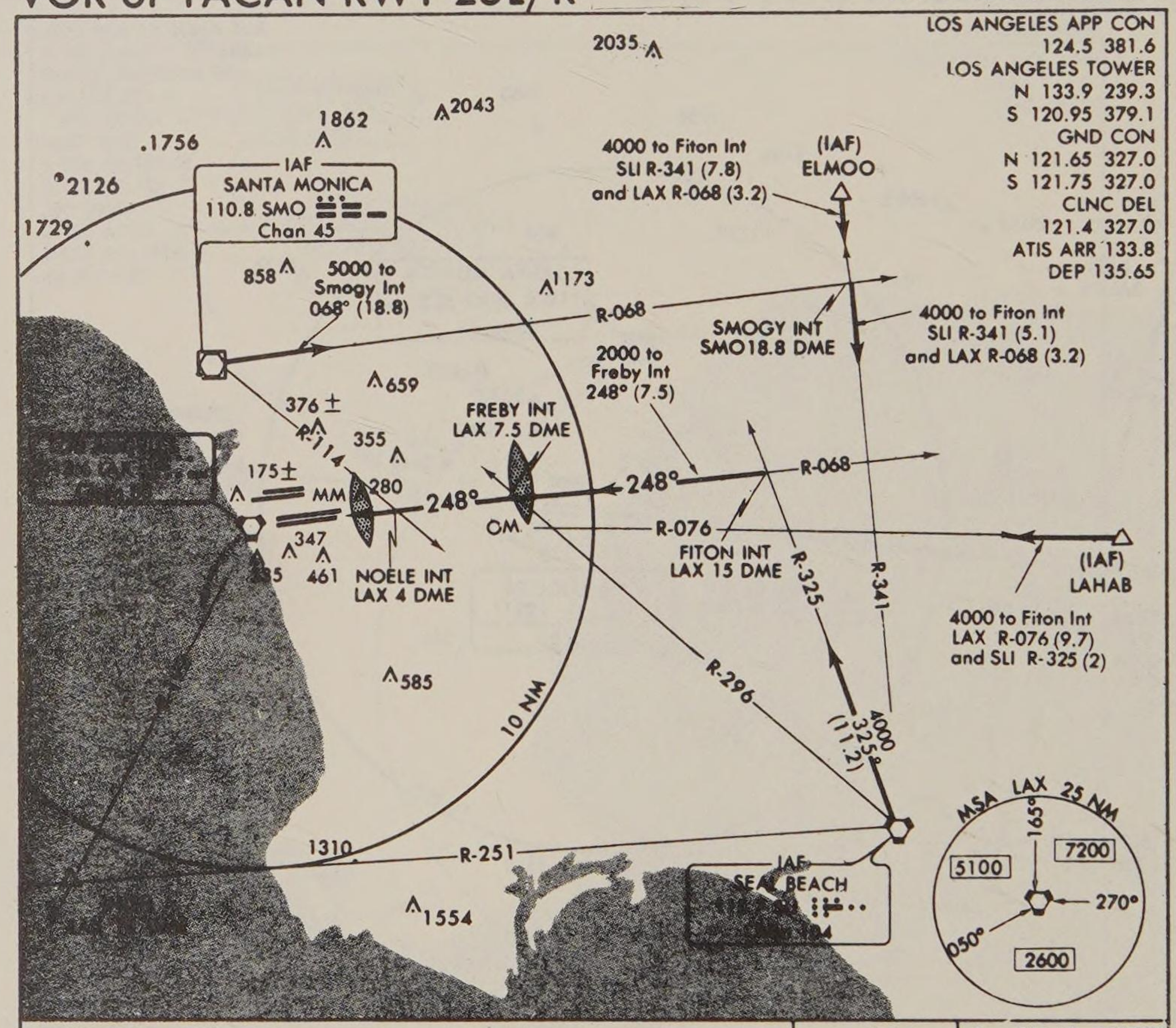
LOS ANGELES, CALIFORNIA
LOS ANGELES INTERNATIONAL(LAX)

Not for use in Navigation

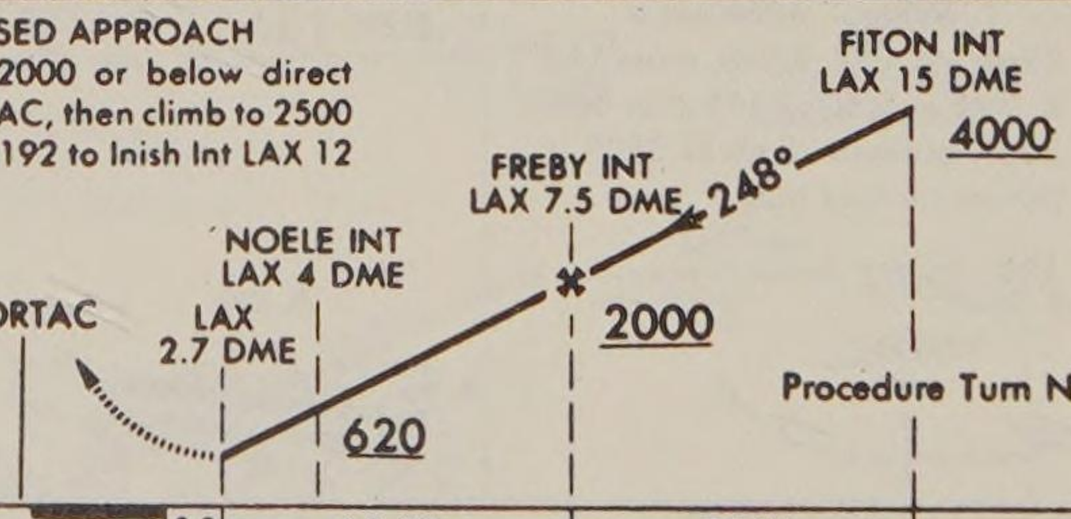
Amdt 13

VOR or TACAN RWY 25L/R

LOS ANGELES INTERNATIONAL (LAX)
LOS ANGELES, CALIFORNIA



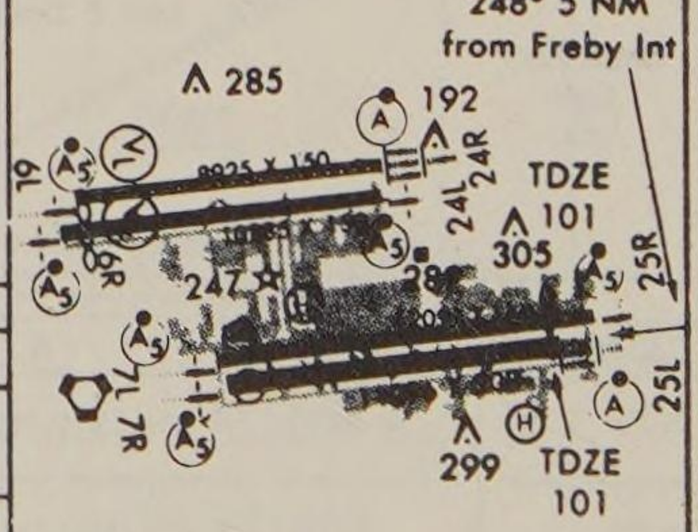
MISSED APPROACH
Climb to 2000 or below direct LAX VORTAC, then climb to 2500 via LAX R-192 to Inish Int LAX 12 DME.



CATEGORY	A	B	C	D
S-25L	620/24 519 (600-½)		620/50 519 (600-1)	620/60 519 (600-1¼)
S-25R	620/24 519 (600-½)		620/50 519 (600-1)	620/60 519 (600-1¼)
DUAL VOR or DME MINIMUMS				
S-25L	540/24 439 (500-½)		540/40 439 (500-¾)	540/50 439 (500-1)
S-25R	540/24 439 (500-½)		540/40 439 (500-¾)	540/50 439 (500-1)

ELEV 126

Rwy 25R ldg 11129'
Rwy 6R ldg 9964'



TDZ/CL Rwys 24R and 25L
HIRL Rwys 7R-25L, 7L-25R,
6R-24L and 6L-24R

FAF to MAP 4.8 NM					
Knots	60	90	120	150	180
Min:Sec	4:48	3:12	2:24	1:55	1:36

VOR or TACAN RWY 25L/R

33°57'N – 118°24'W

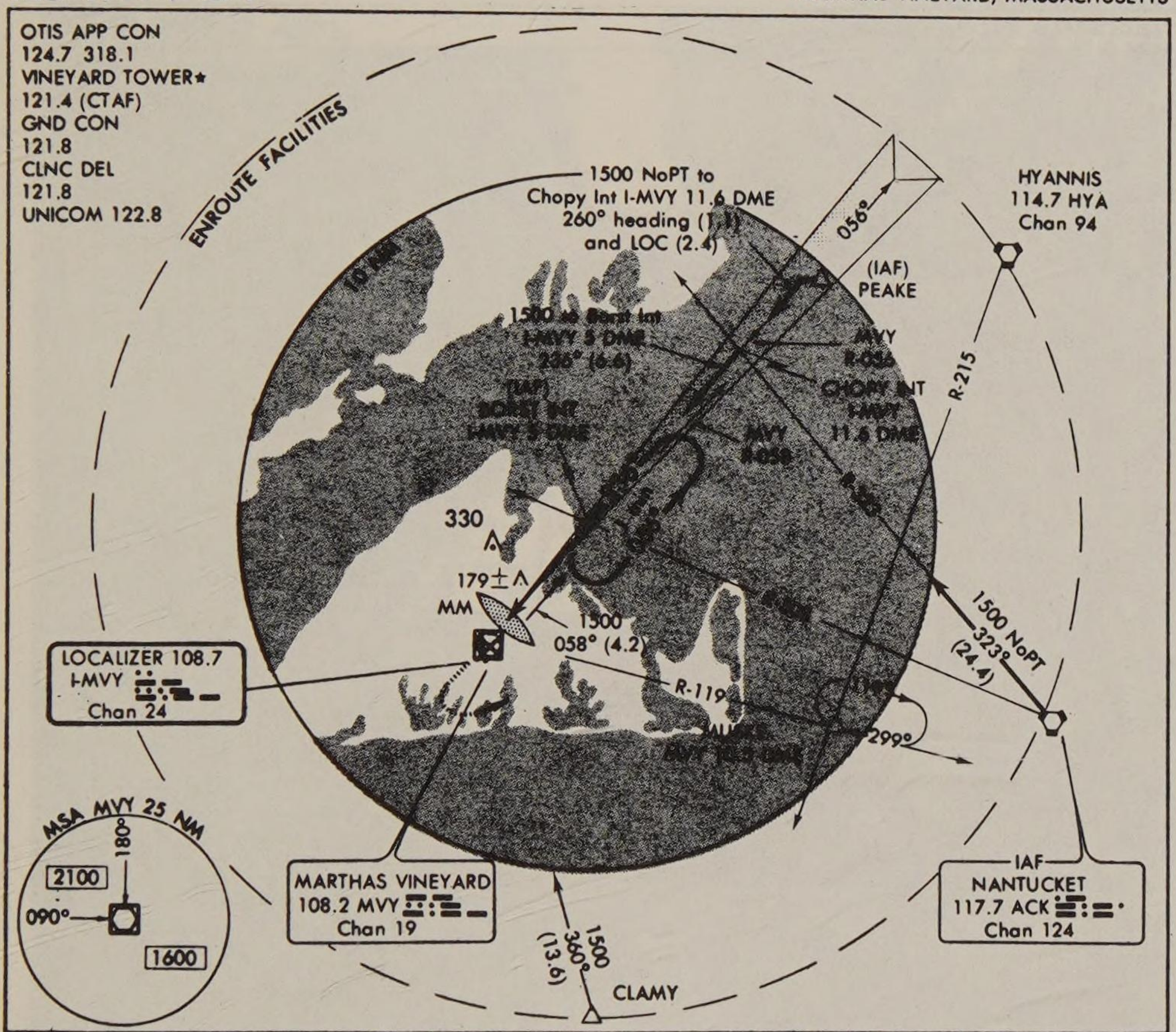
LOS ANGELES, CALIFORNIA
LOS ANGELES INTERNATIONAL (LAX)

Not for use in Navigation

Amdt 7

ILS RWY 24

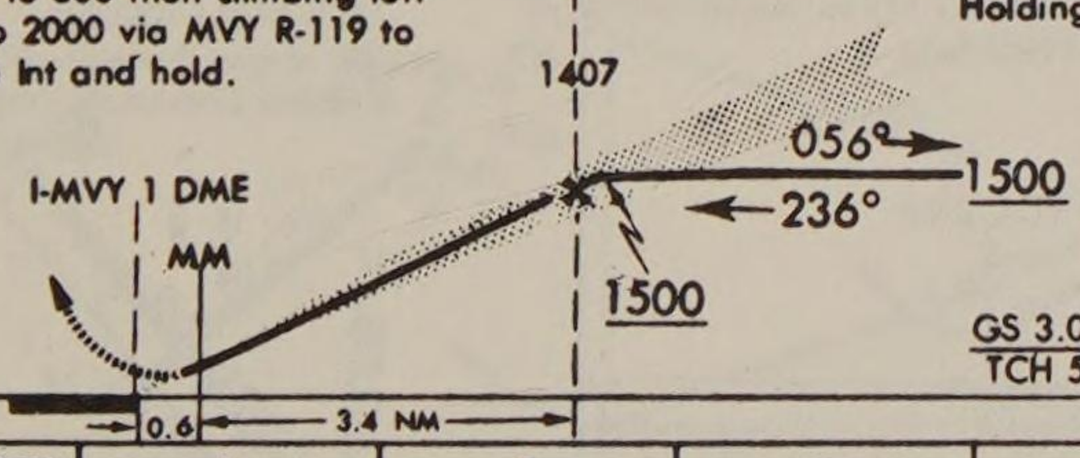
MARTHAS VINEYARD (MVY)
MARTHAS VINEYARD, MASSACHUSETTS



BORST INT
I-MVY 5 DME

MISSED APPROACH
Climb to 800 then climbing left turn to 2000 via MVY R-119 to Muske Int and hold.

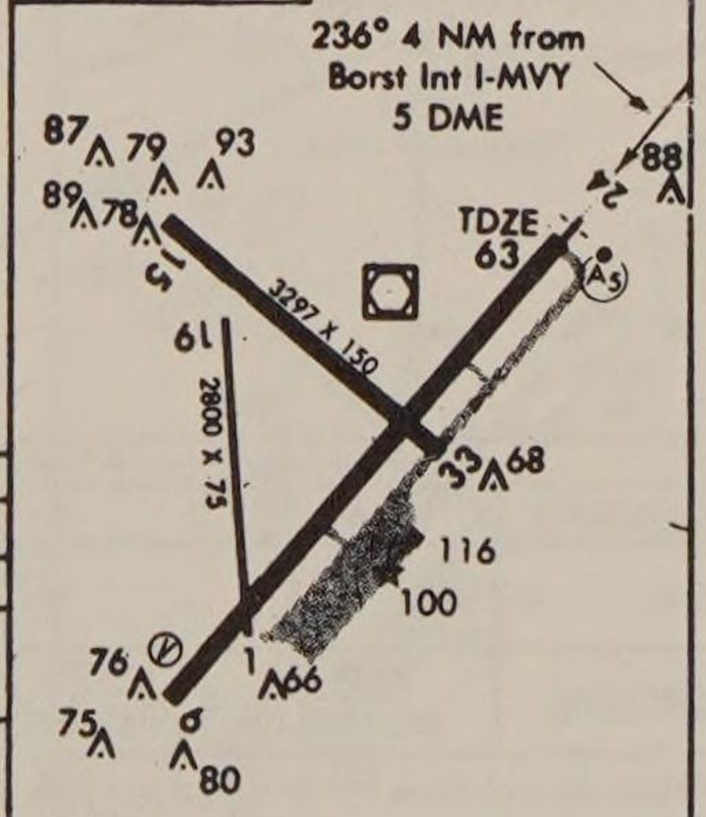
One Minute Holding Pattern



CATEGORY	A	B	C	D
S-ILS 24	263-½ 200 (200-½)			
S-LOC 24	440-½ 377 (400-½)			440-¾ 377 (400-¾)
CIRCLING	460-1 392 (400-1)	520-1 452 (500-1)	520-1½ 452 (500-1½)	620-2 552 (600-2)

When control zone not in effect use Otis altimeter setting and increase all DH/MDAs 60 feet.
Cat. D S-LOC visibility increased ¼ mile for inoperative MM.
ACTIVATE MALSR Rwy 24, HIRL Rwys 6-24, MIRL Rwy 15-33, REIL Rwy 6-CTAF.
⚠ NA

ELEV 68



REIL Rwys 6 and 33
HIRL Rwy 6-24
MIRL Rwy 15-33

FAF to MAP 4 NM					
Knots	60	90	120	150	180
Min:Sec	4:00	2:40	2:00	1:36	1:20

ILS RWY 24

41°24'N – 70°37'W

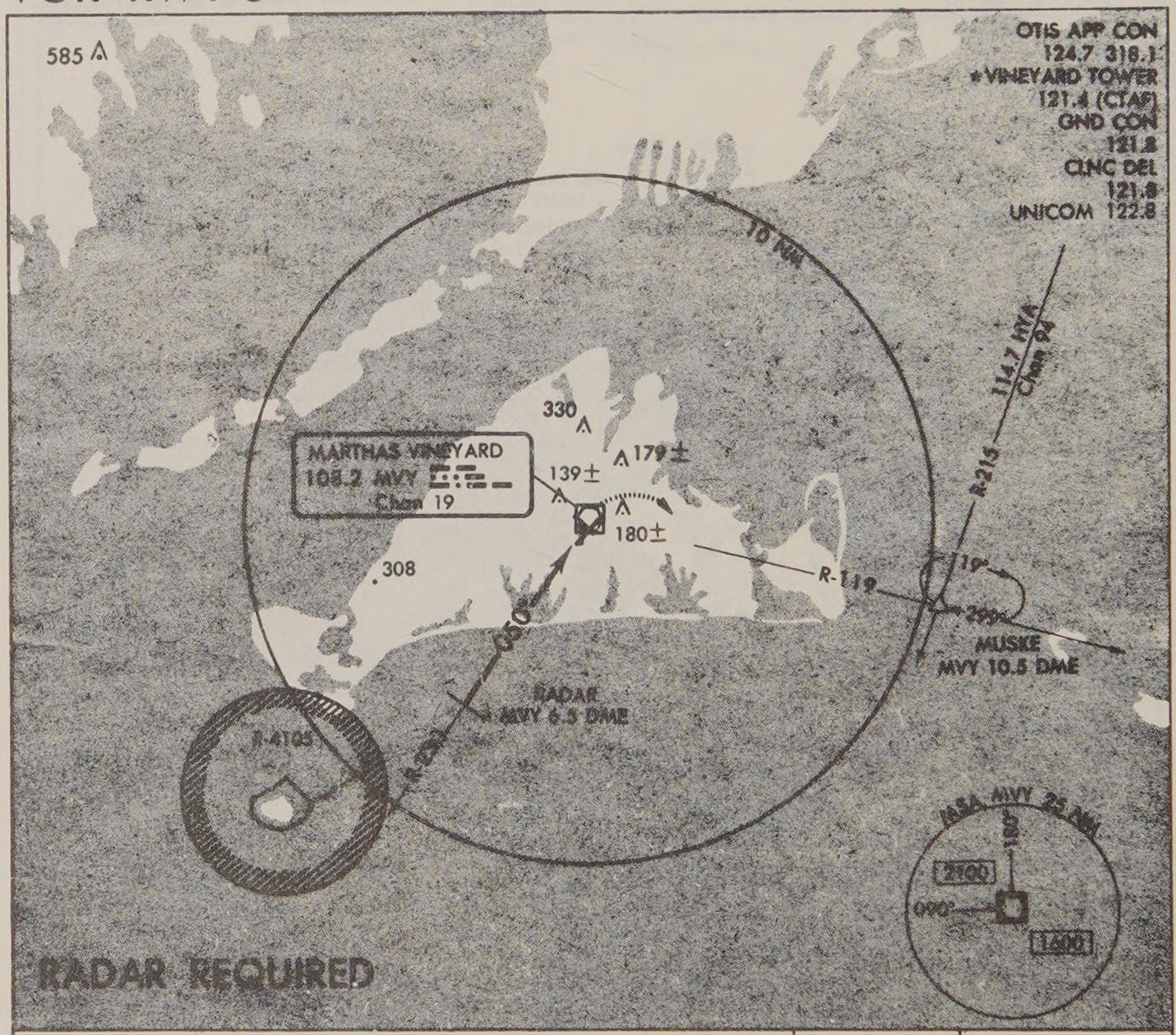
MARTHAS VINEYARD, MASSACHUSETTS
MARTHAS VINEYARD (MVY)

Not for use in Navigation

Amdt 4

VOR RWY 6

MARTHAS VINEYARD (MVY)
MARTHAS VINEYARD, MASSACHUSETTS

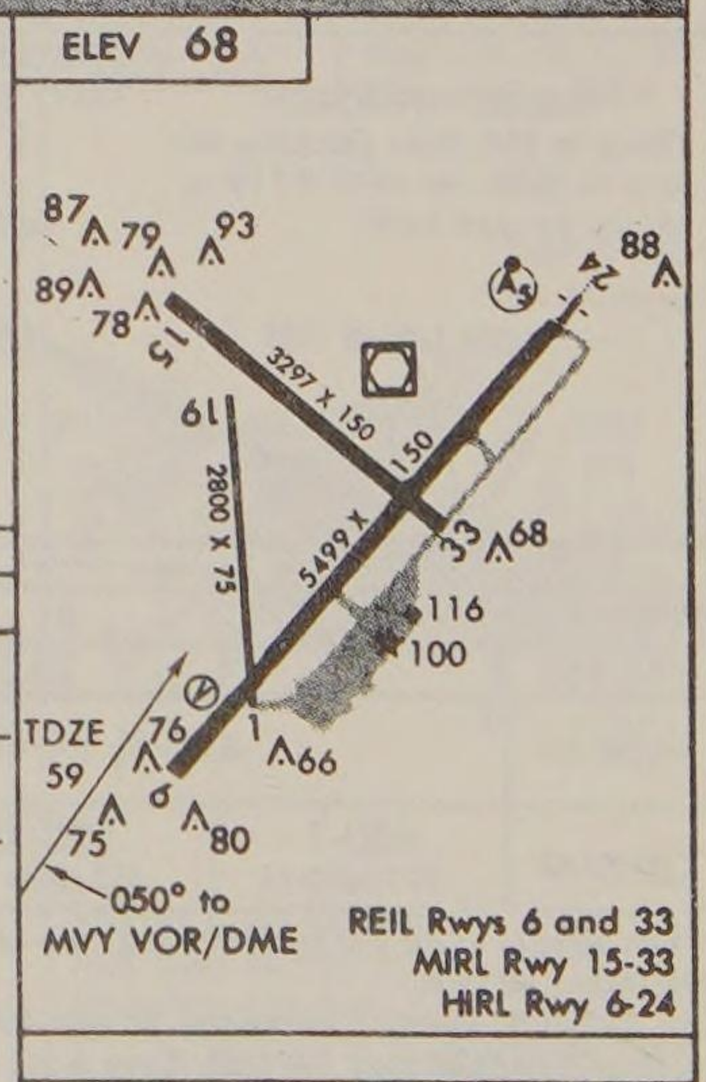


RADAR
MVY 6.5 DME
1700
050°
VOR/DME
6.5 NM

MISSED APPROACH
Climbing right turn to 2000 via MVY R-119 to Muske Int and hold.

CATEGORY	A	B	C	D
S-6	400-1 341 (400-1)			
CIRCLING	460-1 392 (400-1)	520-1 452 (500-1)	520-1½ 452 (500-1½)	620-2 552 (600-2)

When control zone not in effect use Otis altimeter setting and increase all MDAs 60 feet.
ACTIVATE MALSR Rwy 24, HIRL Rwys 6-24, MIRL Rwys 15-33, REIL Rwy 6-CTAF.
A



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 6

41°24'N – 70°37'W

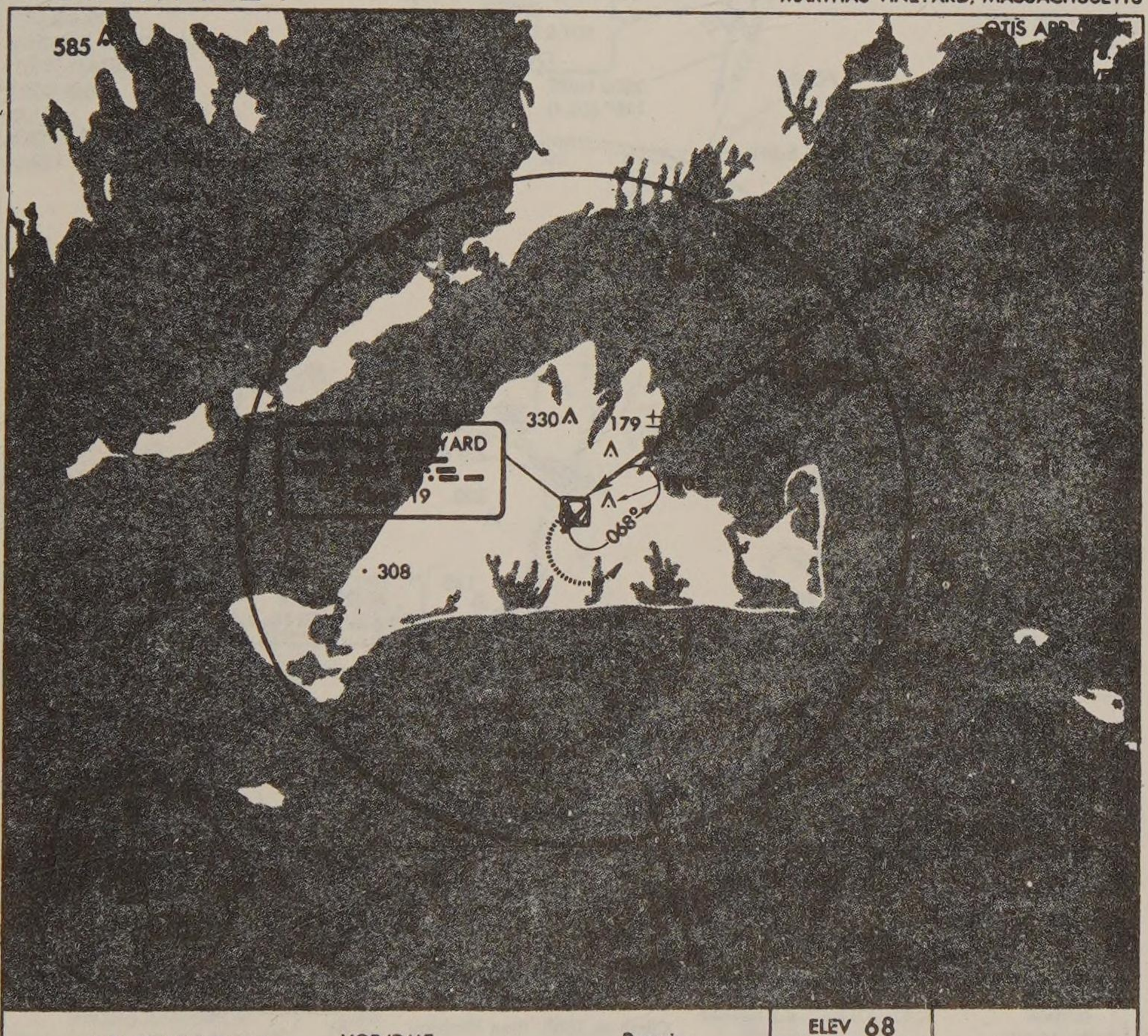
MARTHAS VINEYARD, MASSACHUSETTS
MARTHAS VINEYARD (MVY)

Not for use in Navigation

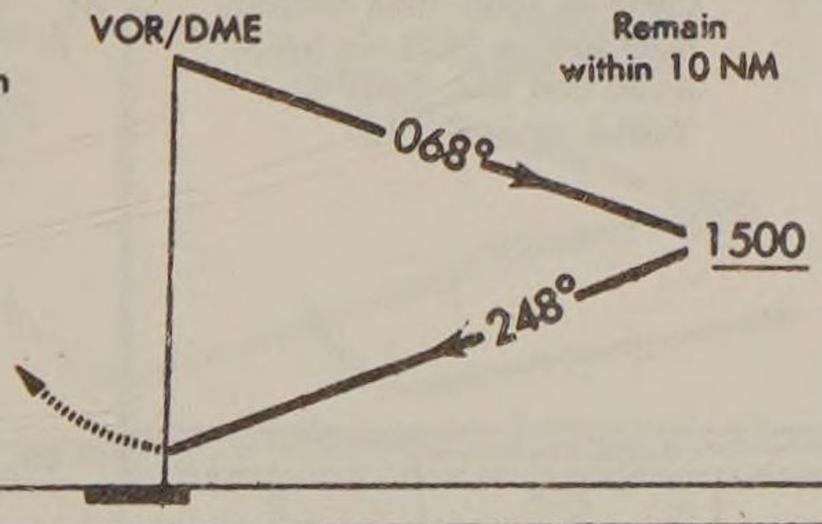
Amdt 11

VOR RWY 24

MARTHAS VINEYARD (MVY)
MARTHAS VINEYARD, MASSACHUSETTS



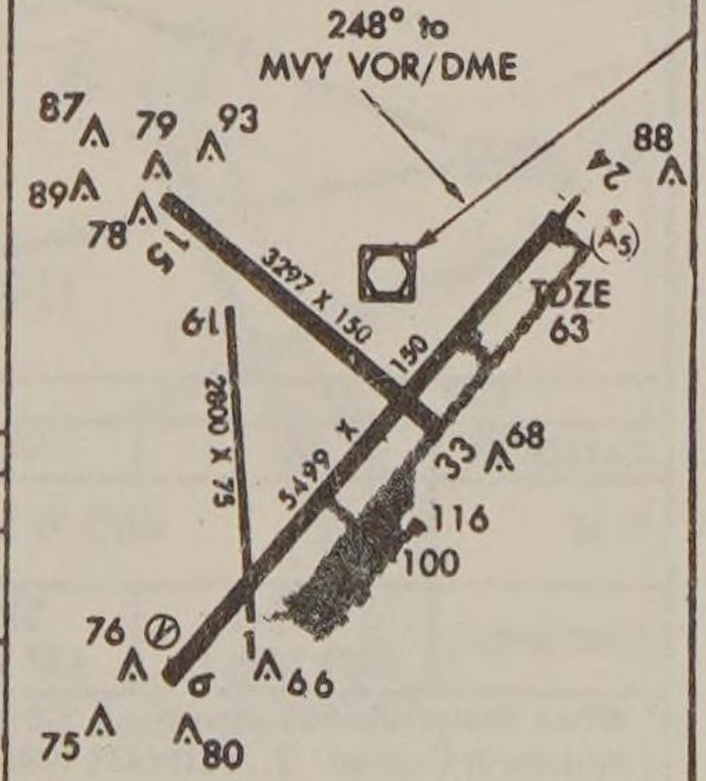
MISSED APPROACH
Climbing left turn to 1500 in MVY VOR/DME holding pattern.



CATEGORY	A	B	C	D
S-24	480-½ 417 (500-½)		480-¾ 417(500-¾)	480-1 417 (500-1)
CIRCLING	480-1 412 (500-1)	520-1 452 (500-1)	520-1½ 452 (500-1½)	620-2 552 (600-2)

Cat. D, S-24 visibility increased ¼ mile for inoperative MALSR.
ACTIVATE MALSR Rwy 24, HIRL Rwys 6-24, MIRL Rwys 15-33, REIL Rwy 6-CTAF.
When control zone not in effect use Otis altimeter setting and increase all MDAs 60 feet.
Ⓐ

ELEV 68



REIL Rwys 6 and 33
MIRL Rwy 15-33
HIRL Rwy 6-24

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 24

41°24'N-70°37'W

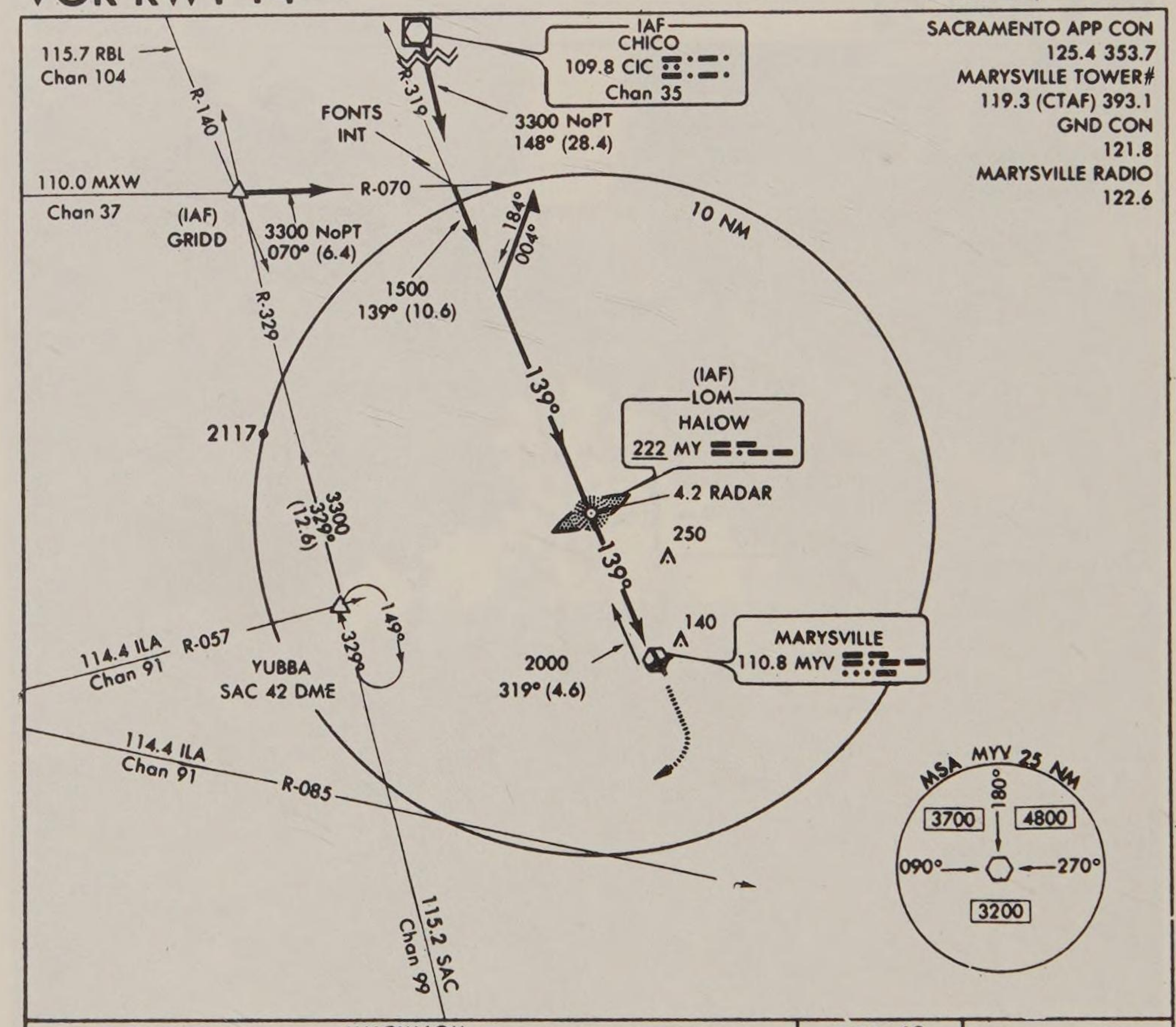
MARTHAS VINEYARD, MASSACHUSETTS
MARTHAS VINEYARD (MVY)

Not for use in Navigation

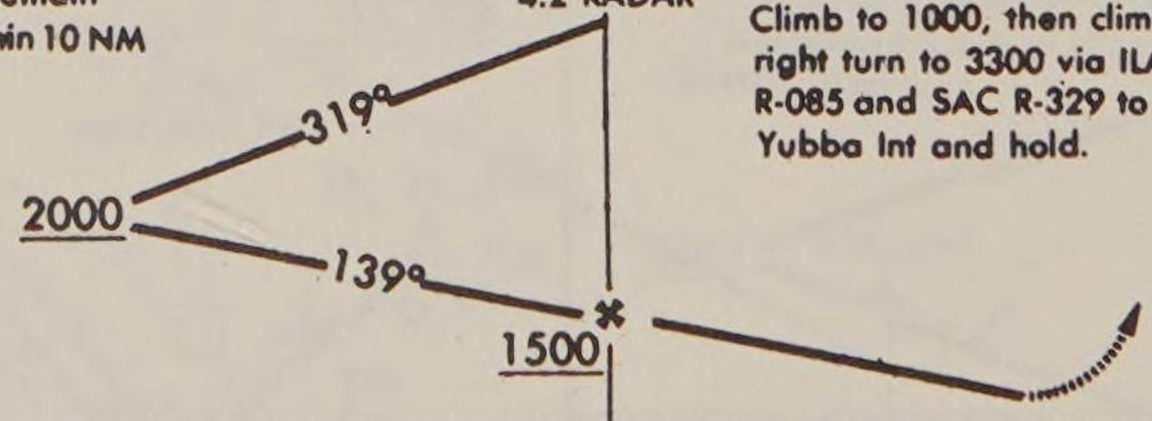
Amdt 7

VOR RWY 14

MARYSVILLE/YUBA CO (MYV)
MARYSVILLE, CALIFORNIA



Remain within 10 NM



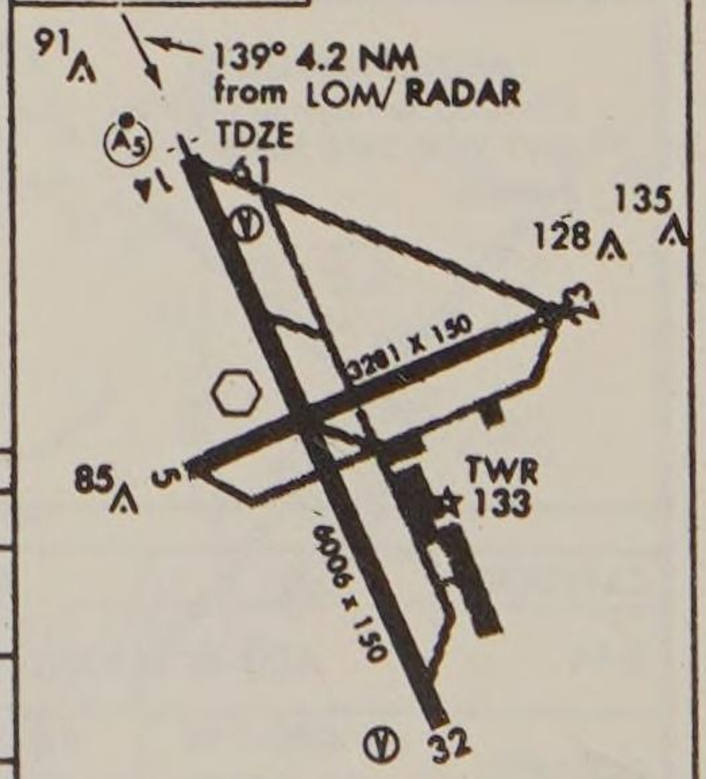
MISSED APPROACH
Climb to 1000, then climbing right turn to 3300 via ILA R-085 and SAC R-329 to Yubba Int and hold.

4.2 NM

CATEGORY	A	B	C	D
S-14	460-½ 399 (400-½)			460-1 399 (400-1)
CIRCLING	460-1 397 (400-1)	520-1 457 (500-1)	520-1½ 457 (500-1½)	620-2 557 (600-2)

When Marysville FSS closed: 1. Obtain Beale AFB altimeter from Sacramento Approach Control. 2. ACTIVATE HIRL Rwy 14-32, VASI Rwy 14 and MALSR Rwy 14-119.3. 3. Increase all MDAs 20 feet.
Cat. D S-14 increase visibility ¼ mile for inoperative MALSR.
ADF, Marker receiver or radar required.

ELEV 62



HIRL Rwy 14-32

A100

FAF to MAP 4.2 NM					
Knots	60	90	120	150	180
Min:Sec	4:12	2:48	2:06	1:41	1:24

VOR RWY 14

39°06'N-121°34'W

MARYSVILLE, CALIFORNIA
MARYSVILLE/YUBA CO (MYV)

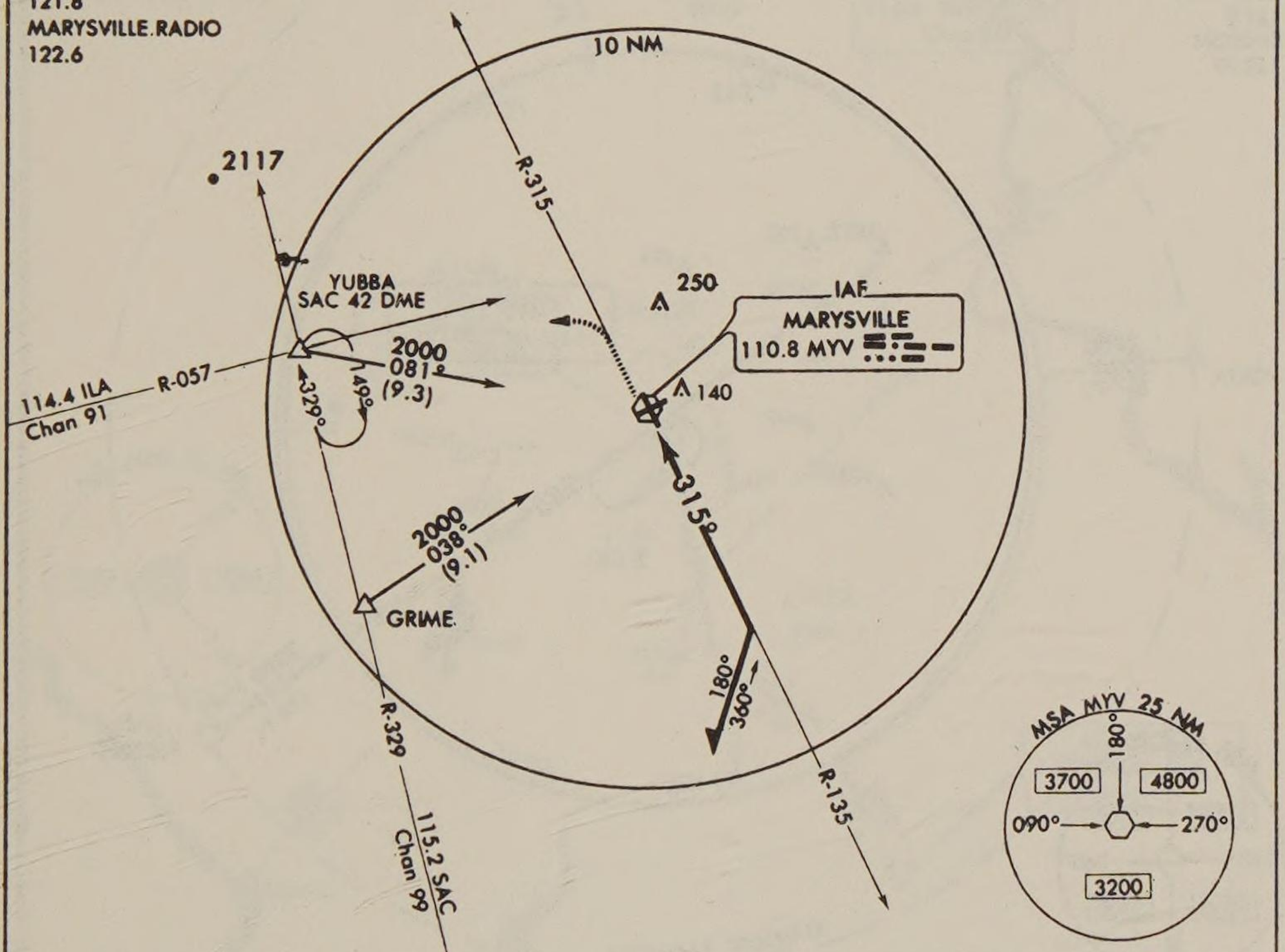
Not for use in Navigation

Amdt 8

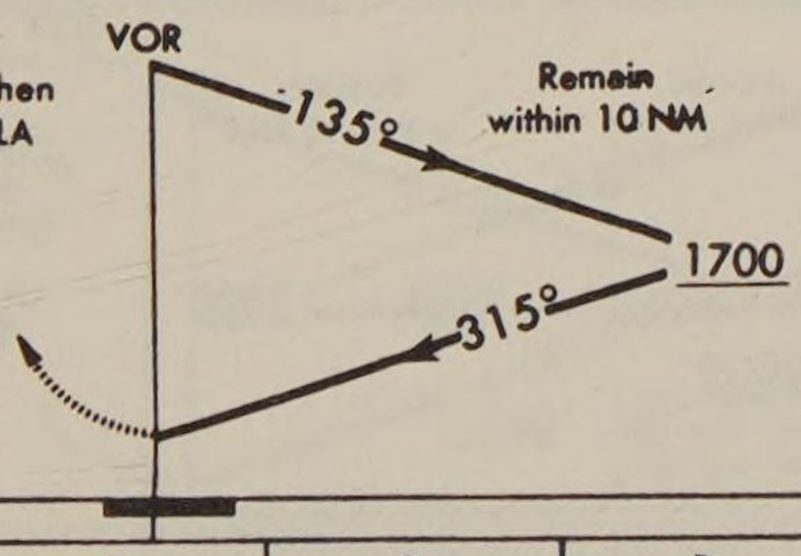
VOR RWY 32

MARYSVILLE/YUBA CO (MYV)
MARYSVILLE, CALIFORNIA

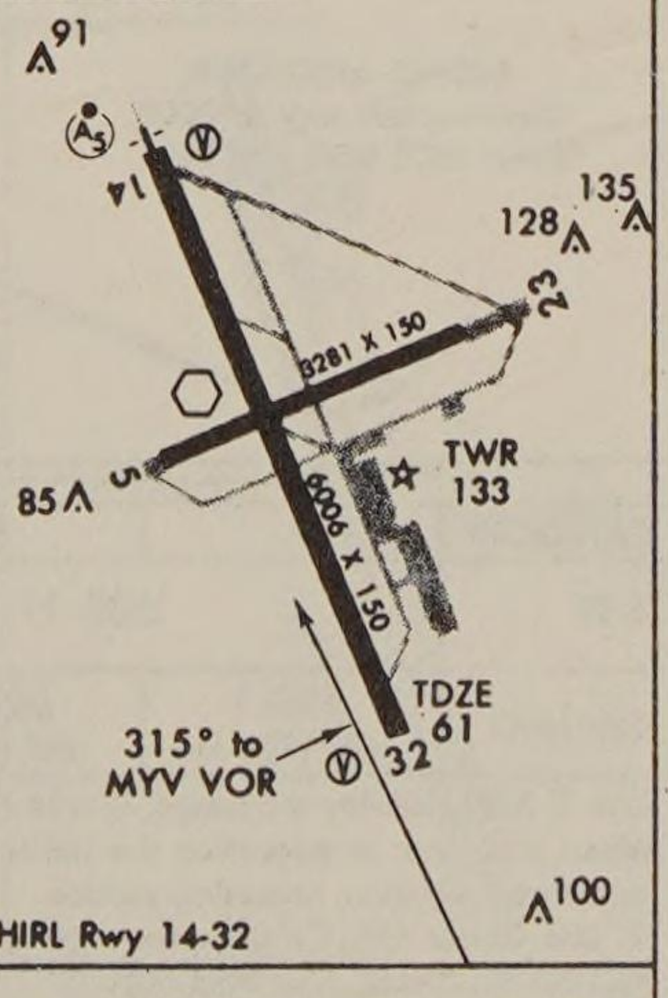
SACRAMENTO APP CON
125.4 353.7
MARYSVILLE TOWER #
119.3 (CTAF) 393.1
GND CON
121.8
MARYSVILLE RADIO
122.6



MISSED APPROACH
Climb to 2000 via MYV R-315, then climbing left turn to 3300 via ILA R-057 to Yubba Int and hold.



ELEV 62



CATEGORY	A	B	C	D
S-32	460-1 399 (400-1)			460-1¼ 399 (400-1¼)
CIRCLING	460-1 397(400-1)	520-1 457(500-1)	520-1½ 457(500-1½)	620-2 557 (600-2)

When Marysville FSS clased: 1. Obtain Beale AFB altimeter from Sacramento Approach Control. 2. ACTIVATE HIRL Rwy 14-32, VASI Rwy 14, and MALSR Rwy 14-119.3.

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 32

39°06'N-121°34'W

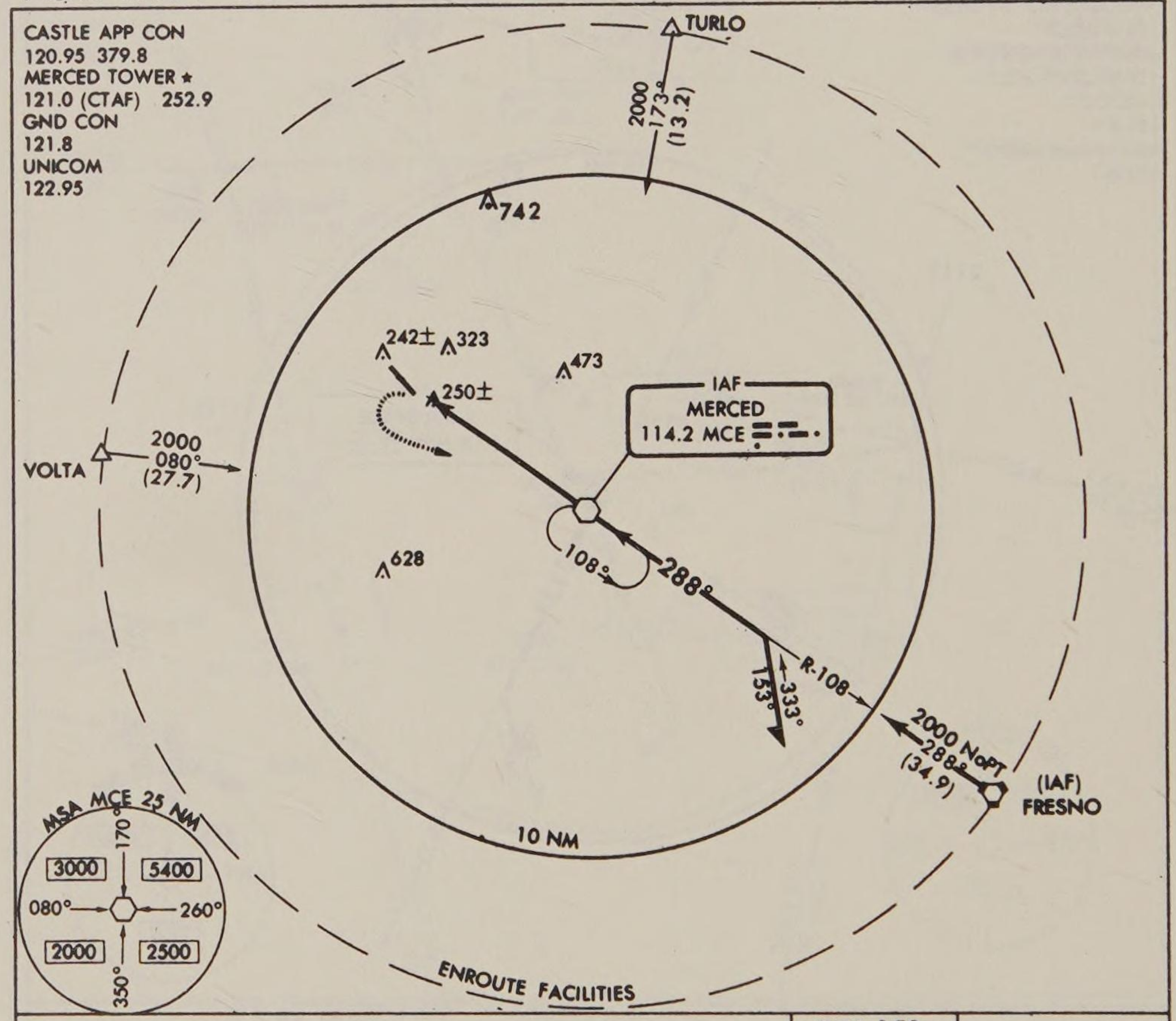
MARYSVILLE, CALIFORNIA
MARYSVILLE/YUBA CO (MYV)

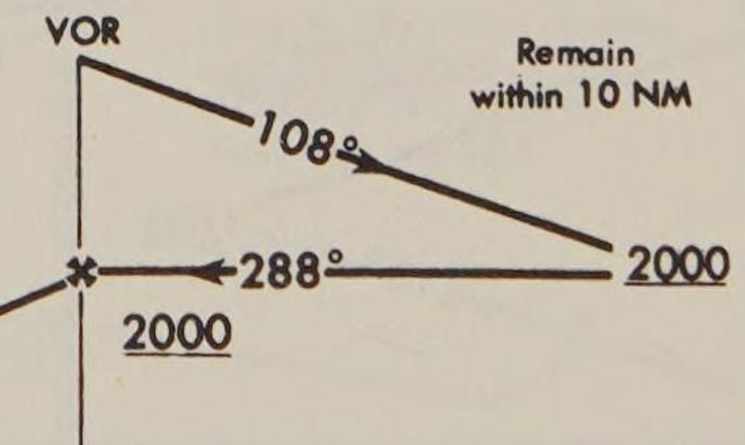
Not for use in Navigation

Amdt 11

VOR RWY 30

MERCED MUNI (MCE)
MERCED, CALIFORNIA



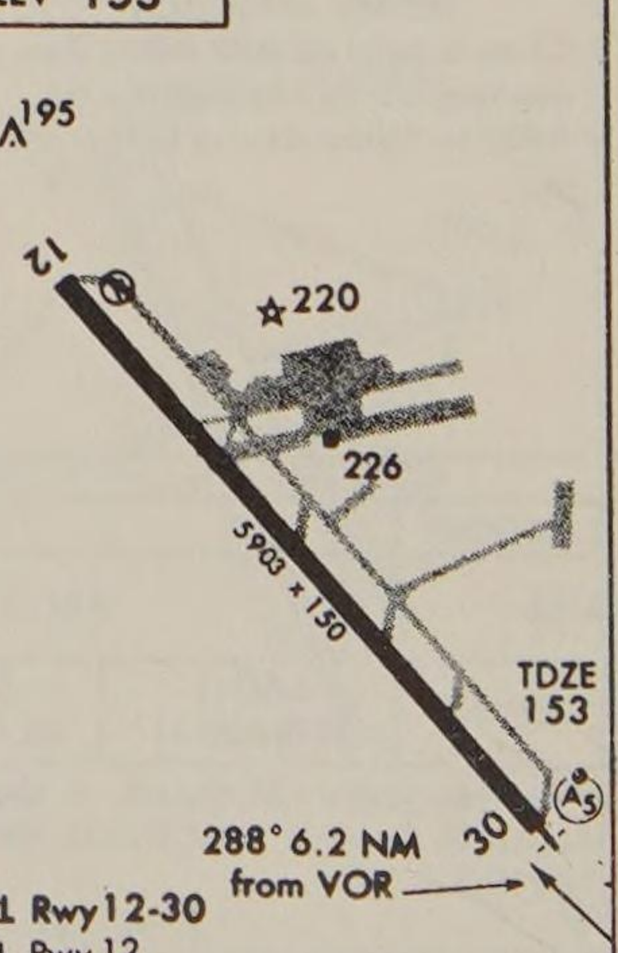


MISSED APPROACH
Climbing left turn to 2000, direct MCE VOR and hold.

CATEGORY	A	B	C	D
S-30	520-½ 367 (400-½)			520-1 367 (400-1)
CIRCLING	580-1 427 (500-1)	620-1 467 (500-1)	640-1½ 487 (500-1½)	720-2 567 (600-2)

Cat. D S-30 visibility increased ¼ mile for inoperative MALSR.
When ATCT not in operation the following applies except for operators with approved weather reporting service: 1. Alternate minimums not authorized. 2. Use Castle AFB, CA altimeter setting.
ACTIVATE MALSR Rwy 30-121.0.

ELEV 153



HIRL Rwy 12-30
REIL Rwy 12

FAF to MAP 6.2 NM					
Knots	60	90	120	150	180
Min:Sec	6:12	4:08	3:06	2:29	2:04

VOR RWY 30

37°17'N-120°31'W

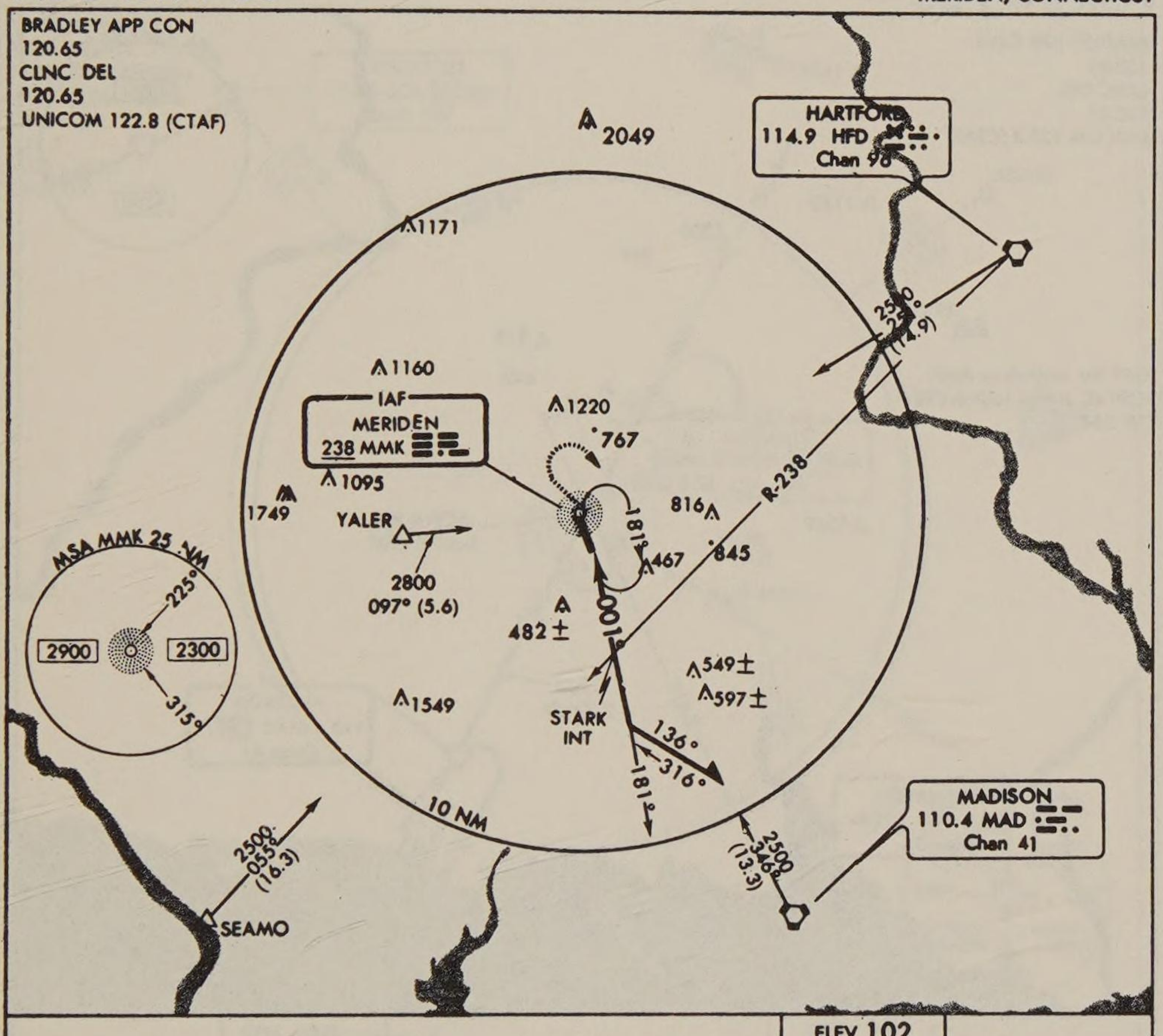
MERCED, CALIFORNIA
MERCED MUNI (MCE)

Not for use in Navigation

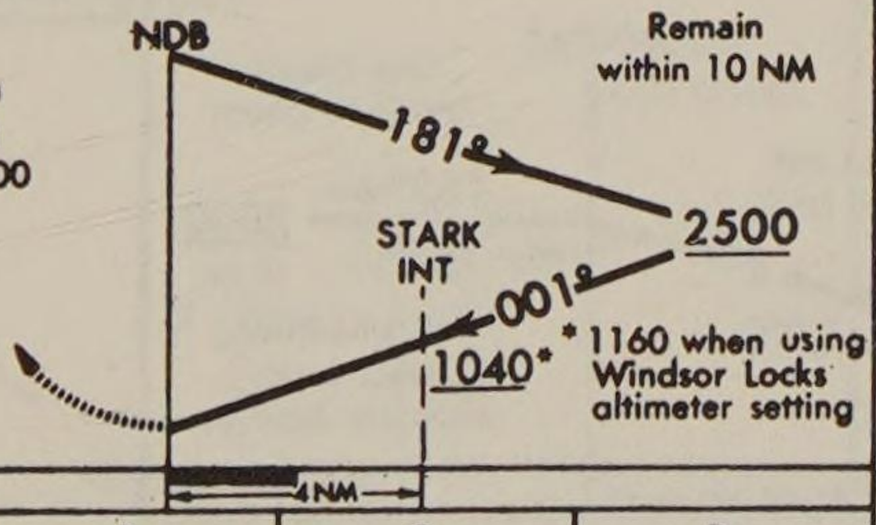
Amdt 4

NDB RWY 36

MERIDEN MARKHAM MUNI (MMK)
MERIDEN, CONNECTICUT



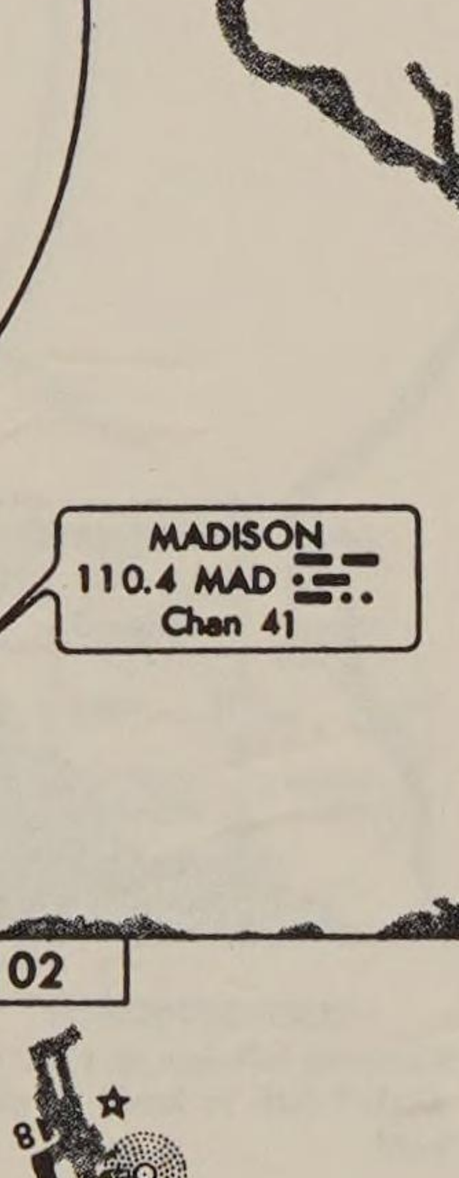
MISSED APPROACH
Climbing left turn to 1300 via 325° bearing from MMK NDB then climbing right turn to 2500 direct MMK NDB and hold.



CATEGORY	A	B	C	D
S-36	1040-1¼ 938 (1000-1¼)		NA	NA
CIRCLING	1040-1¼ 938 (1000-1¼)		NA	NA
NDB/VOR MINIMA				
S-36	800-1 698 (700-1)		NA	NA
CIRCLING	800-1 698 (700-1)		NA	NA

Obtain local altimeter setting on UNICOM 122.8; when not available, use Windsor Locks altimeter setting and increase all MDAs 120 feet. TA NA

ELEV 102



Knots	60	90	120	150	180
Min:Sec					

NDB RWY 36

41° 31'N-72° 50'W

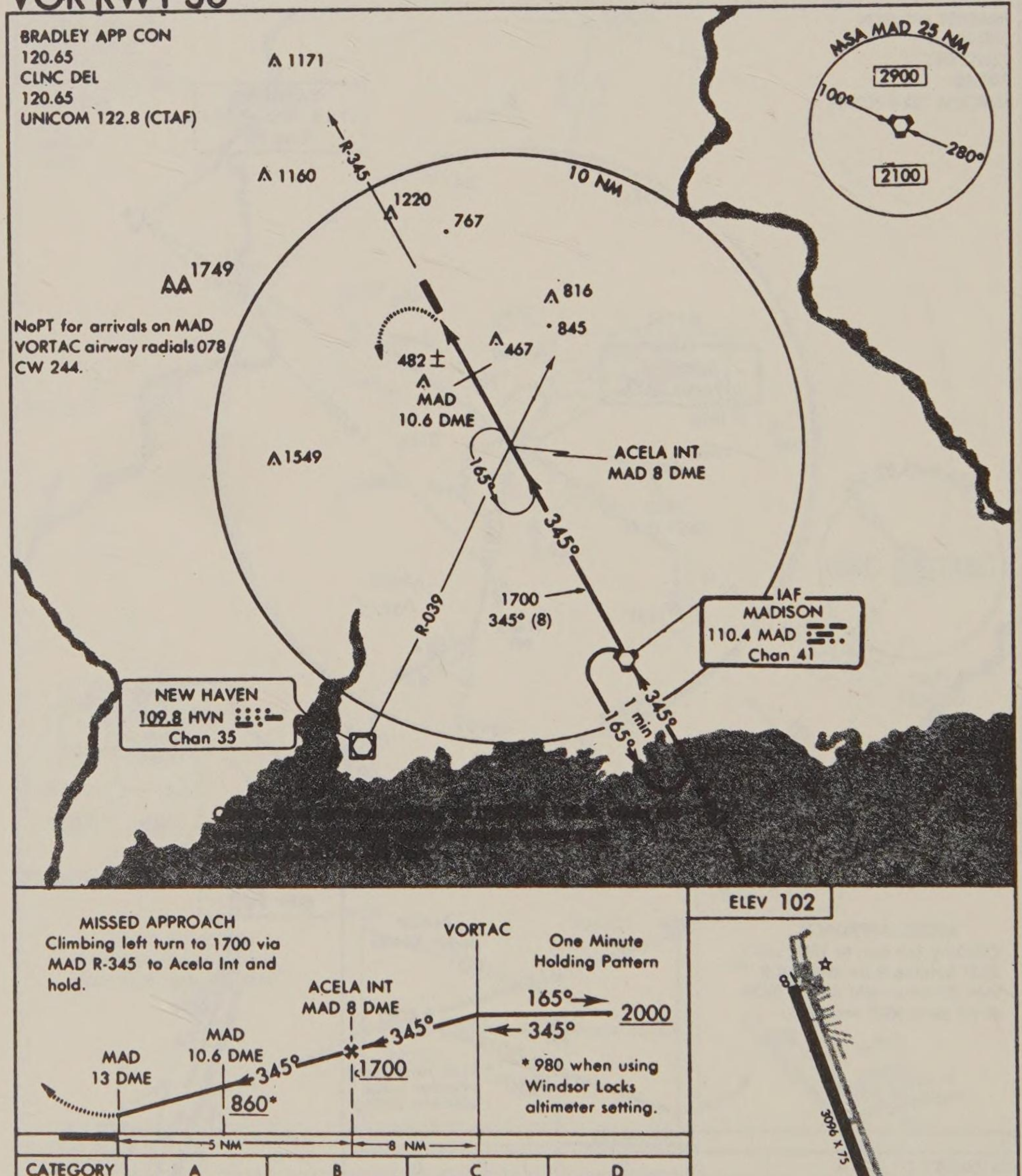
MERIDEN, CONNECTICUT
MERIDEN MARKHAM MUNI (MMK)

Not for use in Navigation

Orig

VOR RWY 36

MERIDEN MARKHAM MUNI (MMK)
MERIDEN, CONNECTICUT

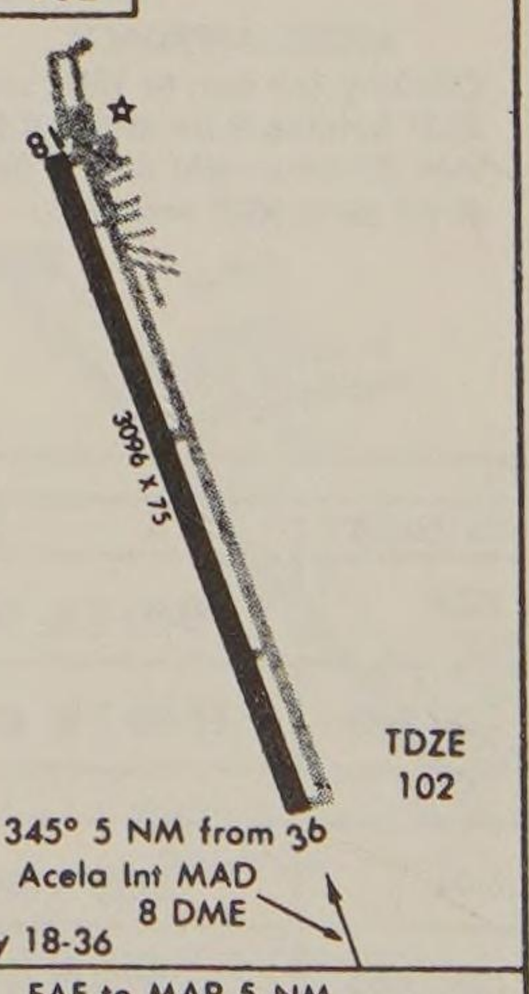


MISSED APPROACH
Climbing left turn to 1700 via MAD R-345 to Acela Int and hold.

CATEGORY	A	B	C	D
S-36	860-1 758 (800-1)	860-1¼ 758 (800-1¼)	NA	
CIRCLING	860-1 758 (800-1)	860-1¼ 758 (800-1¼)	NA	
DME MINIMUMS				
S-36	780-1 678 (700-1)		NA	
CIRCLING	780-1 678 (700-1)		NA	

▽△ NA

ELEV 102



FAF to MAP 5 NM					
Knots	60	90	120	150	180
Min:Sec	5:00	3:20	2:30	2:00	1:40

VOR RWY 36

41°31'N-72°50'W

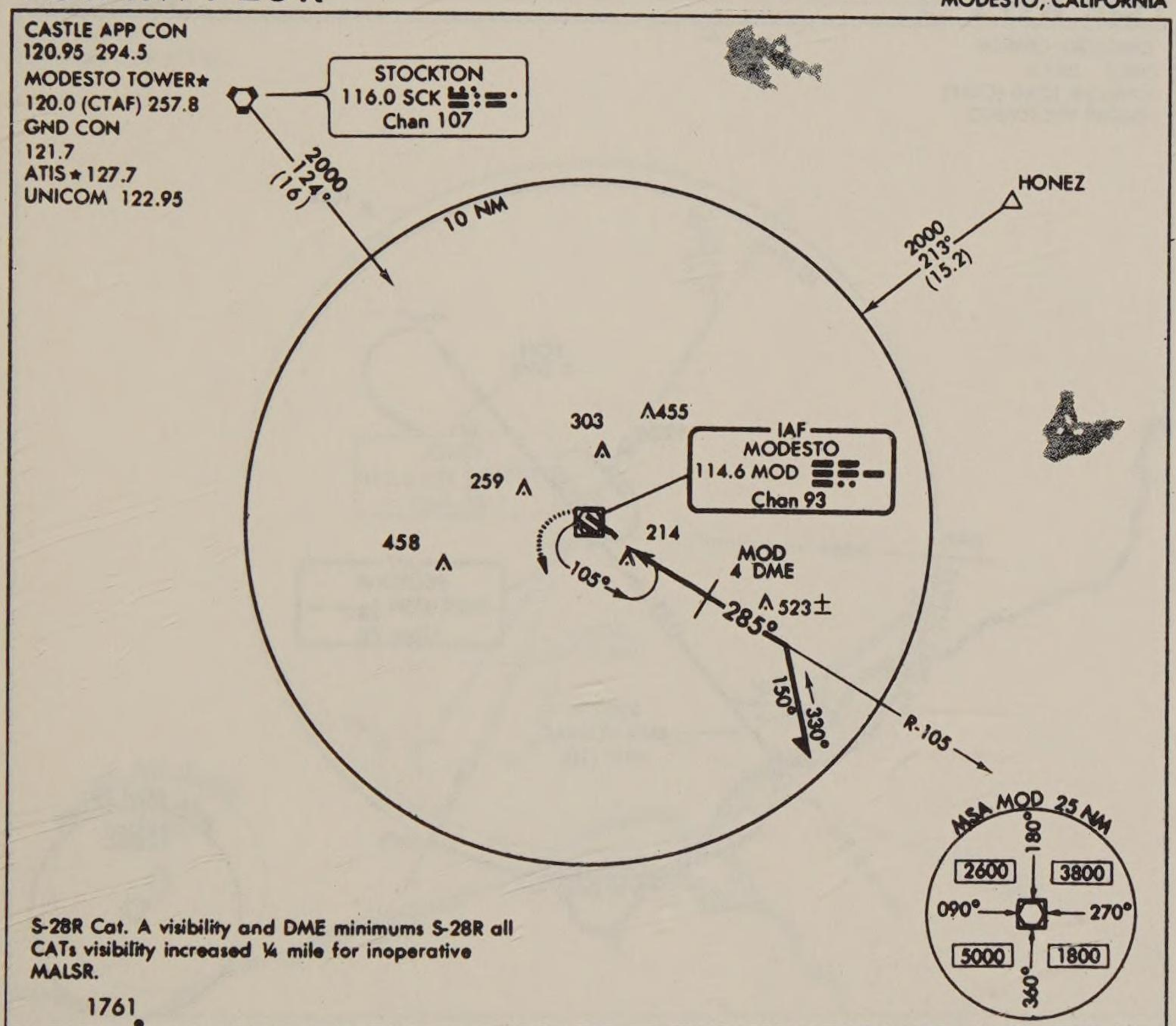
MERIDEN, CONNECTICUT
MERIDEN MARKHAM MUNI (MMK)

Not for use in Navigation

Amdt 10

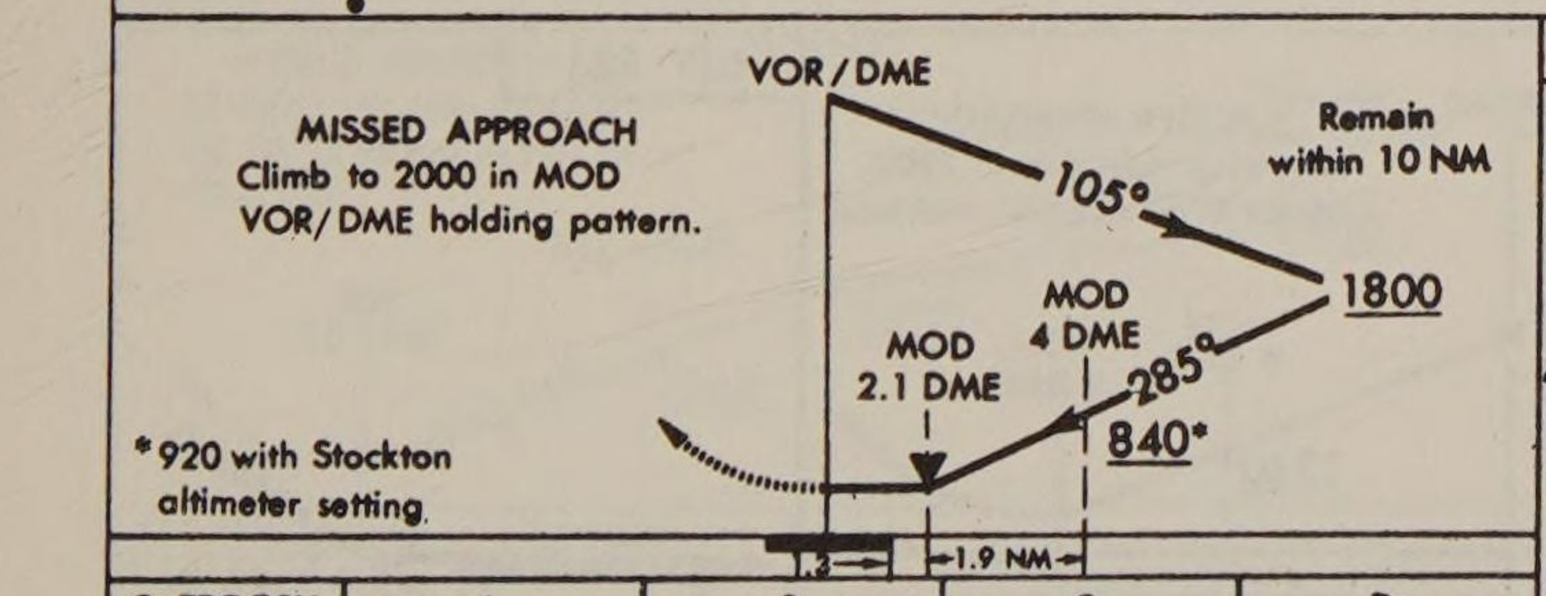
VOR RWY 28R

AIRPORT-HARRY SHAM FIELD (MOD)
MODESTO, CALIFORNIA



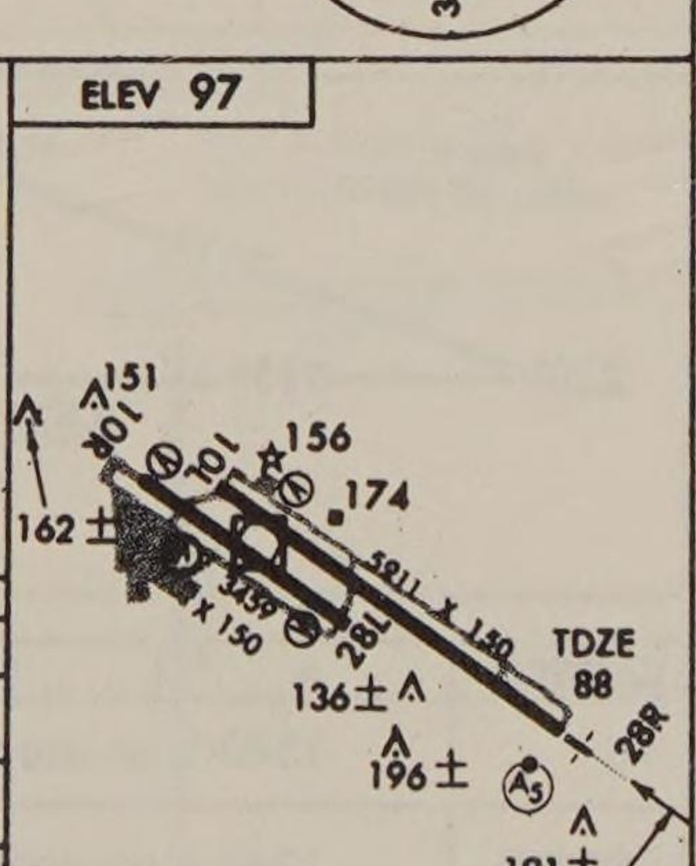
S-28R Cat. A visibility and DME minimums S-28R all CATs visibility increased ¼ mile for inoperative MALSR.

1761



CATEGORY	A	B	C	D
S-28R	840-¾ 752 (800-¾)		840-1¾ 752 (800-1¾)	840-2 752 (800-2)
CIRCLING	840-1 743(800-1)	840-1¼ 743(800-1¼)	840-2¼ 743 (800-2¼)	840-2½ 743 (800-2½)
DME MINIMUMS				
S-28R	480-¾ 392 (400-¾)			480-1 392 (400-1)
CIRCLING	560-1 463 (500-1)		560-1½ 463 (500-1½)	660-2 563(600-2)

When control zone not in effect: 1. Except for operators with approved weather reporting service, use Stockton altimeter setting and increase all MDAs 80 feet. 2. ACTIVATE HIRL Rwy 10L-28R and MALSR Rwy 28R-CTAF.



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 28R

37°38'N-120°58'W
MODESTO, CALIFORNIA
MODESTO CITY-COUNTY AIRPORT-HARRY SHAM FIELD (MOD)

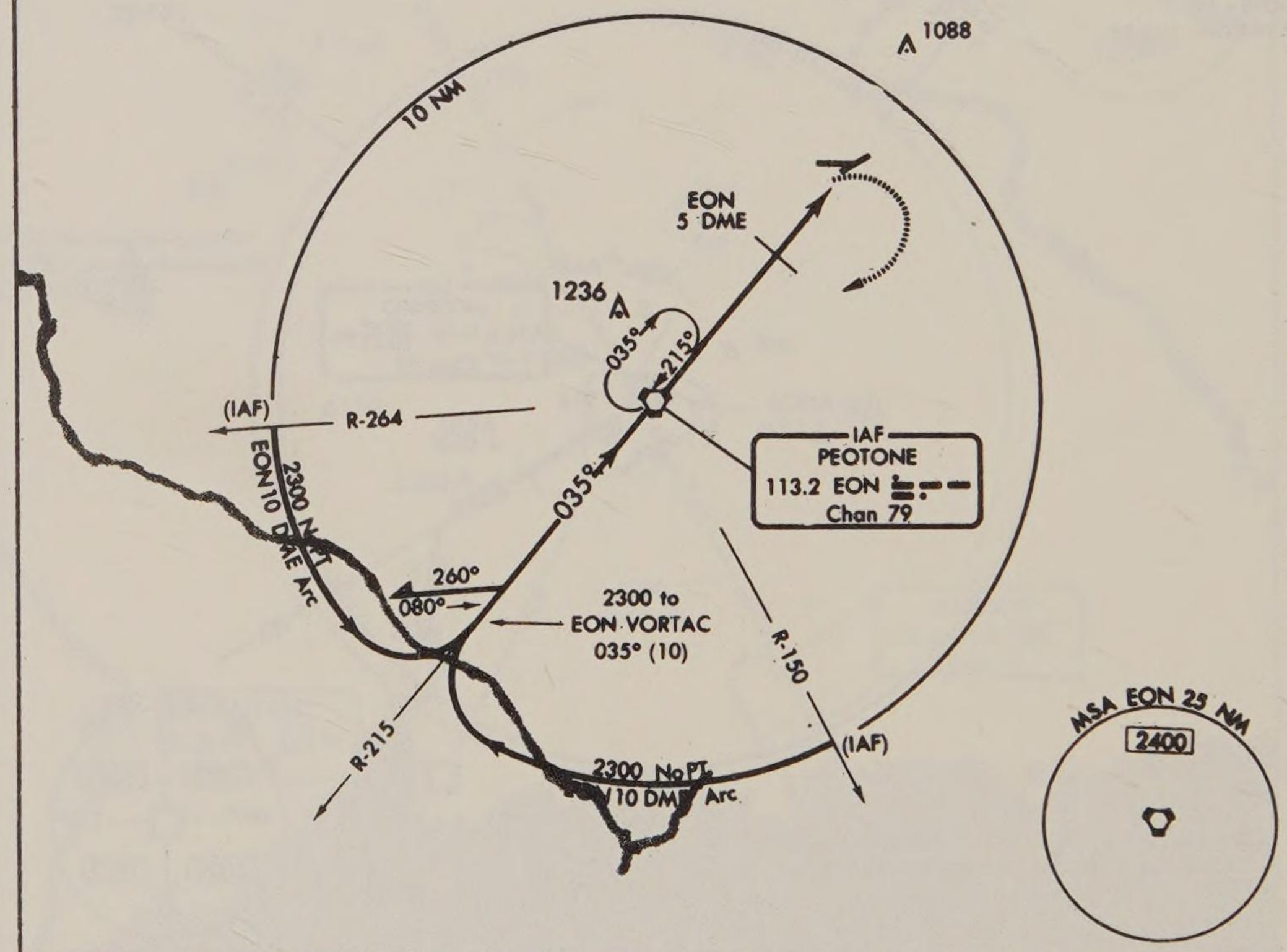
Not for use in Navigation

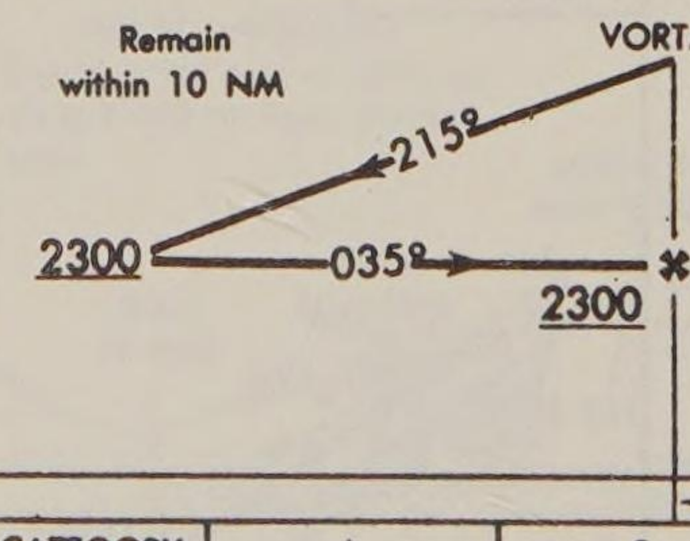
Amdt 1

VOR RWY 5

MONEE/SANGER (C56)
MONEE, ILLINOIS

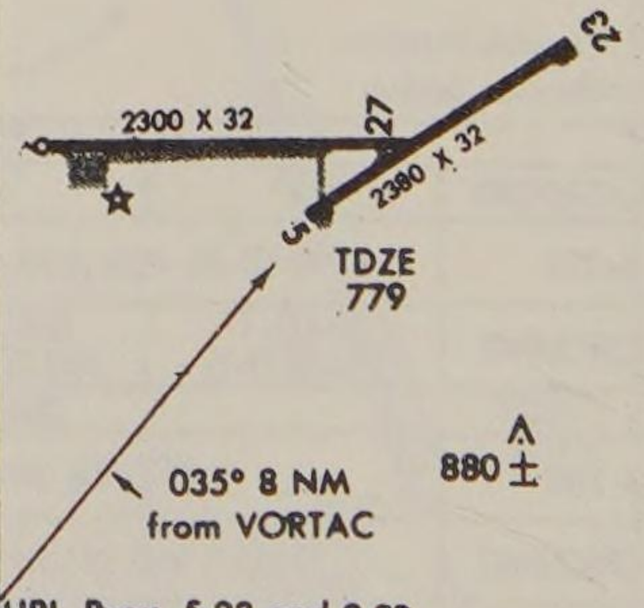
CHICAGO CENTER
133.7 387.1
UNICOM 123.0 (CTAF)
RADAR VECTORING





MISSED APPROACH
Climbing right turn to 2300,
direct EON VORTAC and hold.

ELEV 786



LIRL Rwys 5-23 and 9-27

CATEGORY	A	B	C	D
S-5	1340-1 561 (600-1)		1340-1½ 561 (600-1½)	NA
CIRCLING	1340-1 554 (600-1)		1340-1½ 554 (600-1½)	NA
DME MINIMUMS				
S-5	1240-1 461 (500-1)		1240-1¼ 461 (500-1¼)	NA

Use Chicago Midway Airport, altimeter setting.
Procedure not authorized at night except by prior arrangement for runway lights.
▲ NA

FAF to MAP 8 NM

Knots	60	90	120	150	180
Min:Sec	8:00	5:20	4:00	3:12	2:40

VOR RWY 5

41°23'N – 87°41'W

MONEE, ILLINOIS
MONEE/SANGER (C56)

Not for use in Navigation

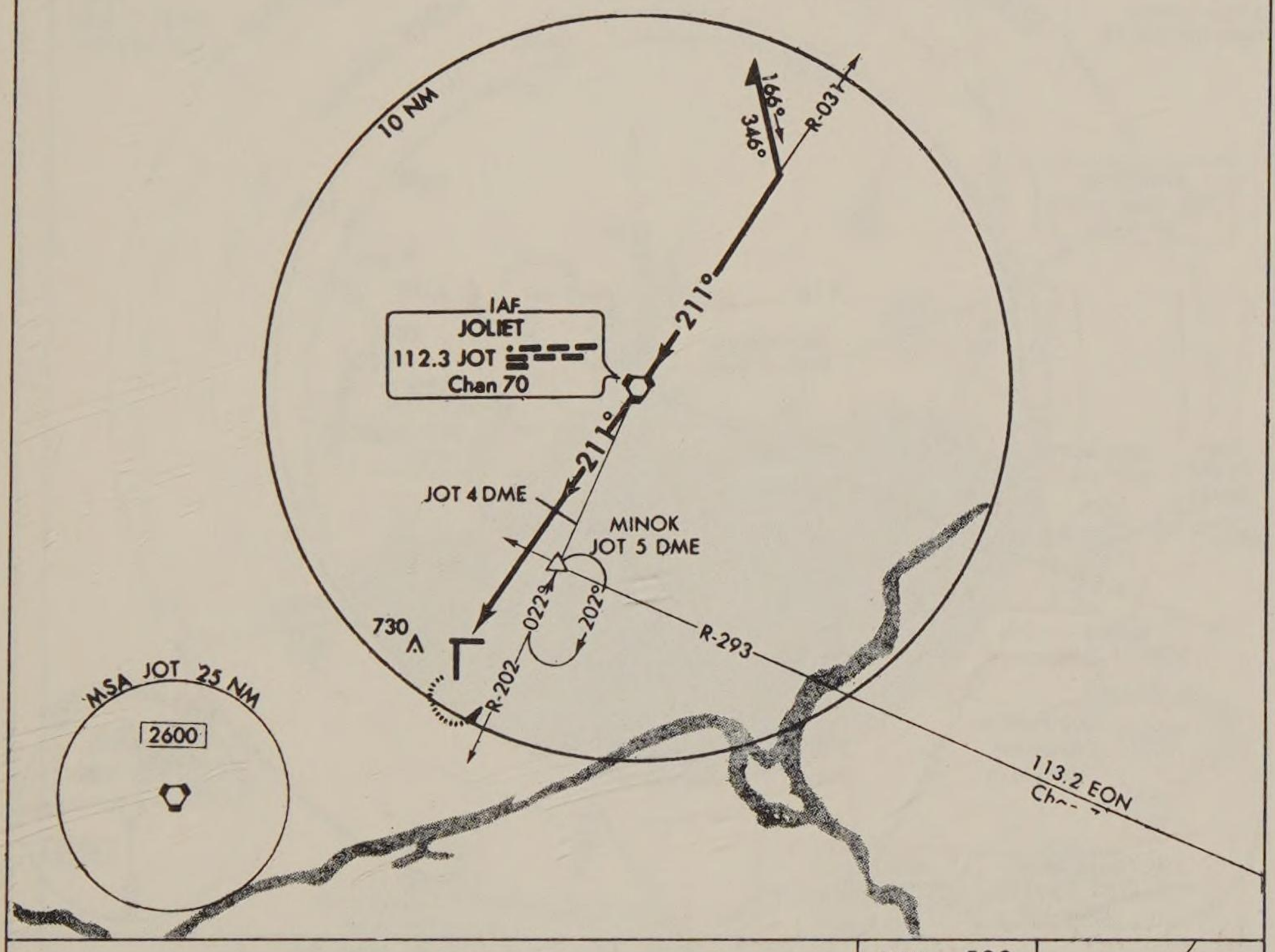
Amdt 8

VOR-A

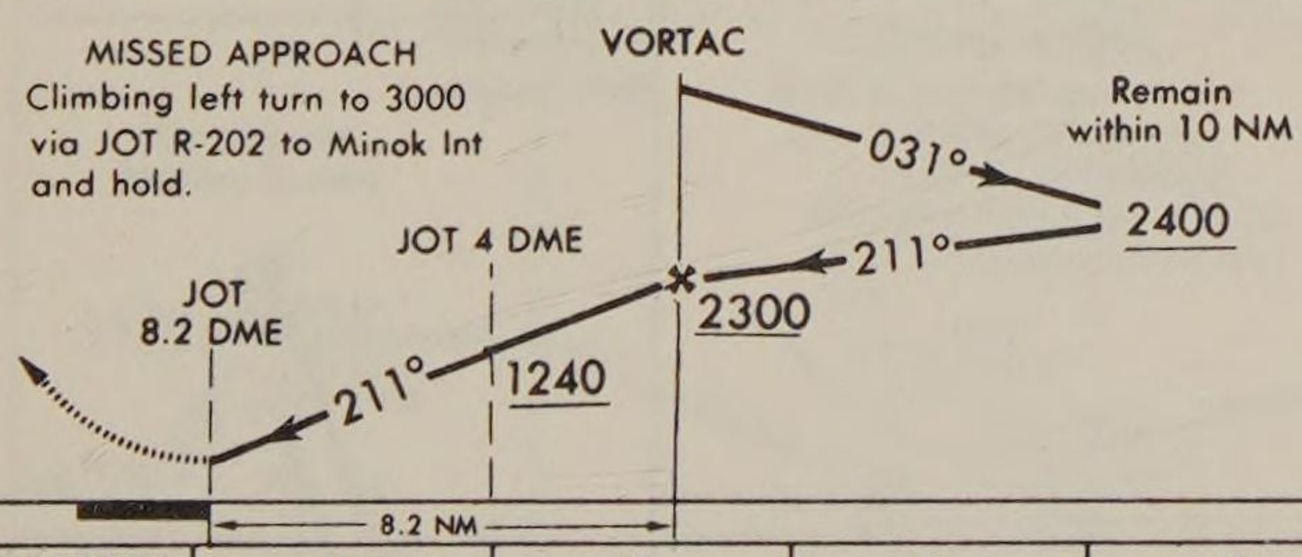
MORRIS MUNI (CØ9)

MORRIS, ILLINOIS

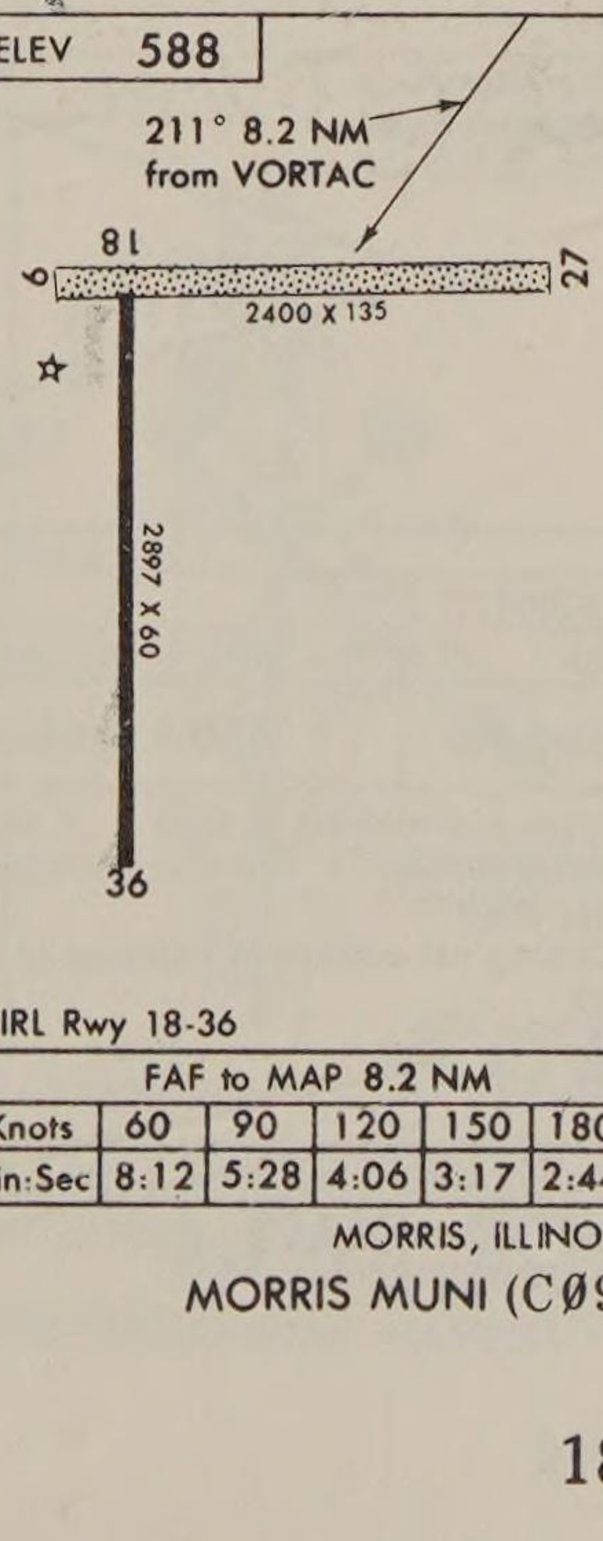
CHICAGO APP CON
133.5 388.0
UNICOM 122.8 (CTAF)



MISSED APPROACH
Climbing left turn to 3000 via JOT R-202 to Minok Int and hold.



ELEV 588



MIRL Rwy 18-36

CATEGORY	A	B	C	D
CIRCLING	1240-1 652 (700-1)		1240-1¾ 652 (700-1¾)	NA

DME MINIMA

CIRCLING	1160-1 572 (600-1)	1160-1½ 572 (600-1½)	NA

Use DuPage, altimeter setting.
Procedure NA at night except by prior arrangement for runway lights.
ⒶNA

FAF to MAP 8.2 NM					
Knots	60	90	120	150	180
Min:Sec	8:12	5:28	4:06	3:17	2:44

VOR-A

41°26'N-88°25'W

MORRIS, ILLINOIS

MORRIS MUNI (CØ9)

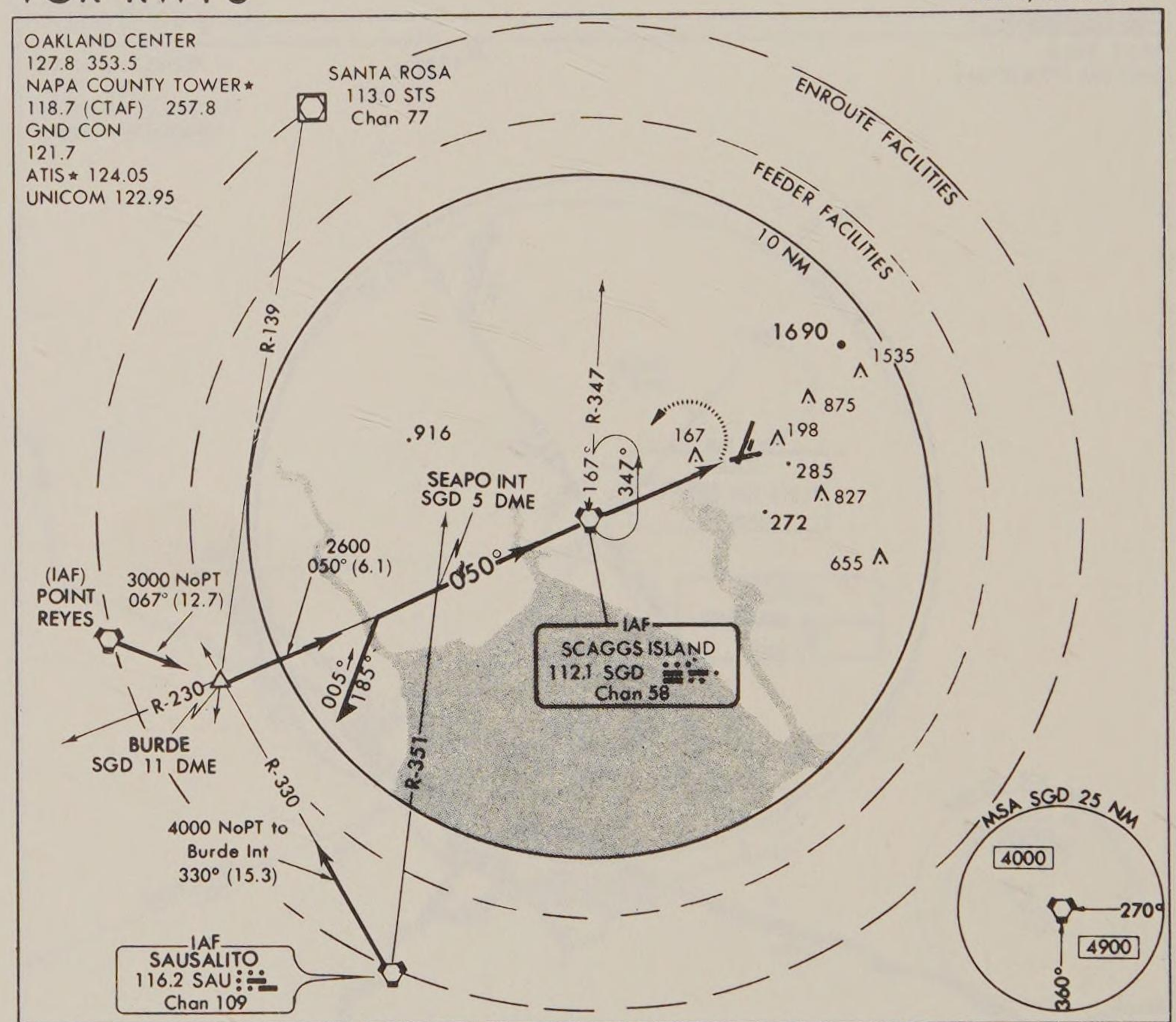
Not for use in Navigation

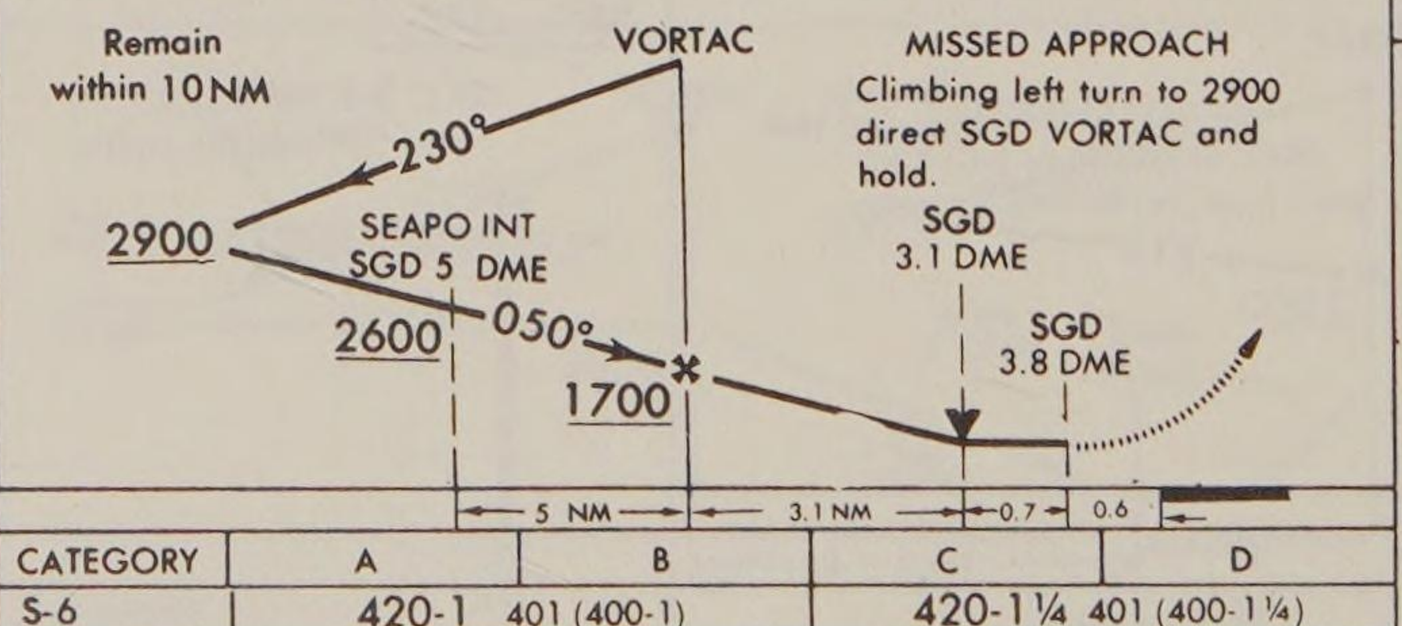
Amdt 10

VOR RWY 6

NAPA COUNTY (APC)
NAPA, CALIFORNIA

OAKLAND CENTER
127.8 353.5
NAPA COUNTY TOWER★
118.7 (CTAF) 257.8
GND CON
121.7
ATIS★ 124.05
UNICOM 122.95



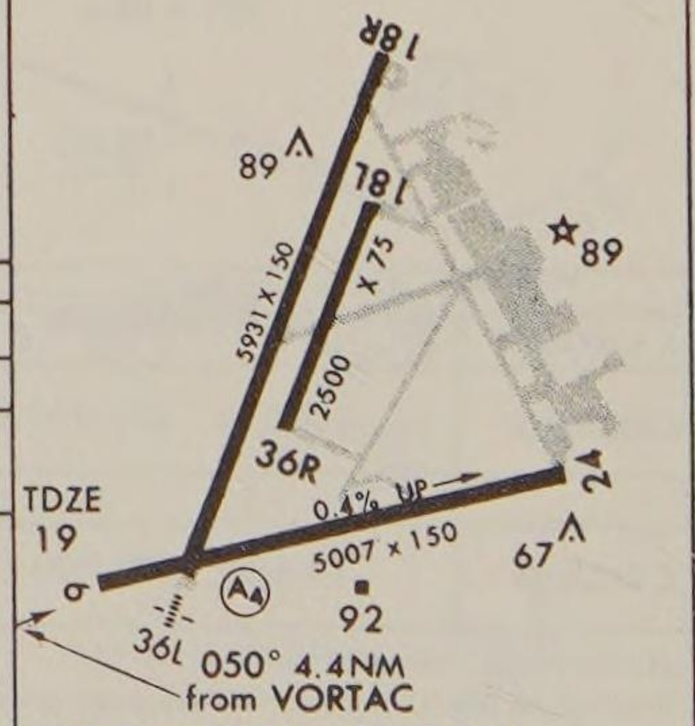


CATEGORY	A	B	C	D
S-6	420-1 401 (400-1)		420-1¼ 401 (400-1¼)	
CIRCLING	620-1 587(600-1)		620-1½ 587 (600-1½)	1140-3 1107 (1200-3)

When control tower closed: 1. Use Travis AFB altimeter setting. 2. Increase all MDAs 60 feet. 3. Alternate minimums not authorized. 4. ACTIVATE MALS Rwy 36L-118.7.
Circling not authorized northeast of Runways 18R and 24.

ELEV 33

REIL Rwy 6



MIRL Rwys 6-24 and 18R-36L

FAF to MAP 3.8 NM					
Knots	60	90	120	150	180
Min:Sec	3:48	2:32	1:54	1:31	1:16

VOR RWY 6

38°13'N-122°17'W

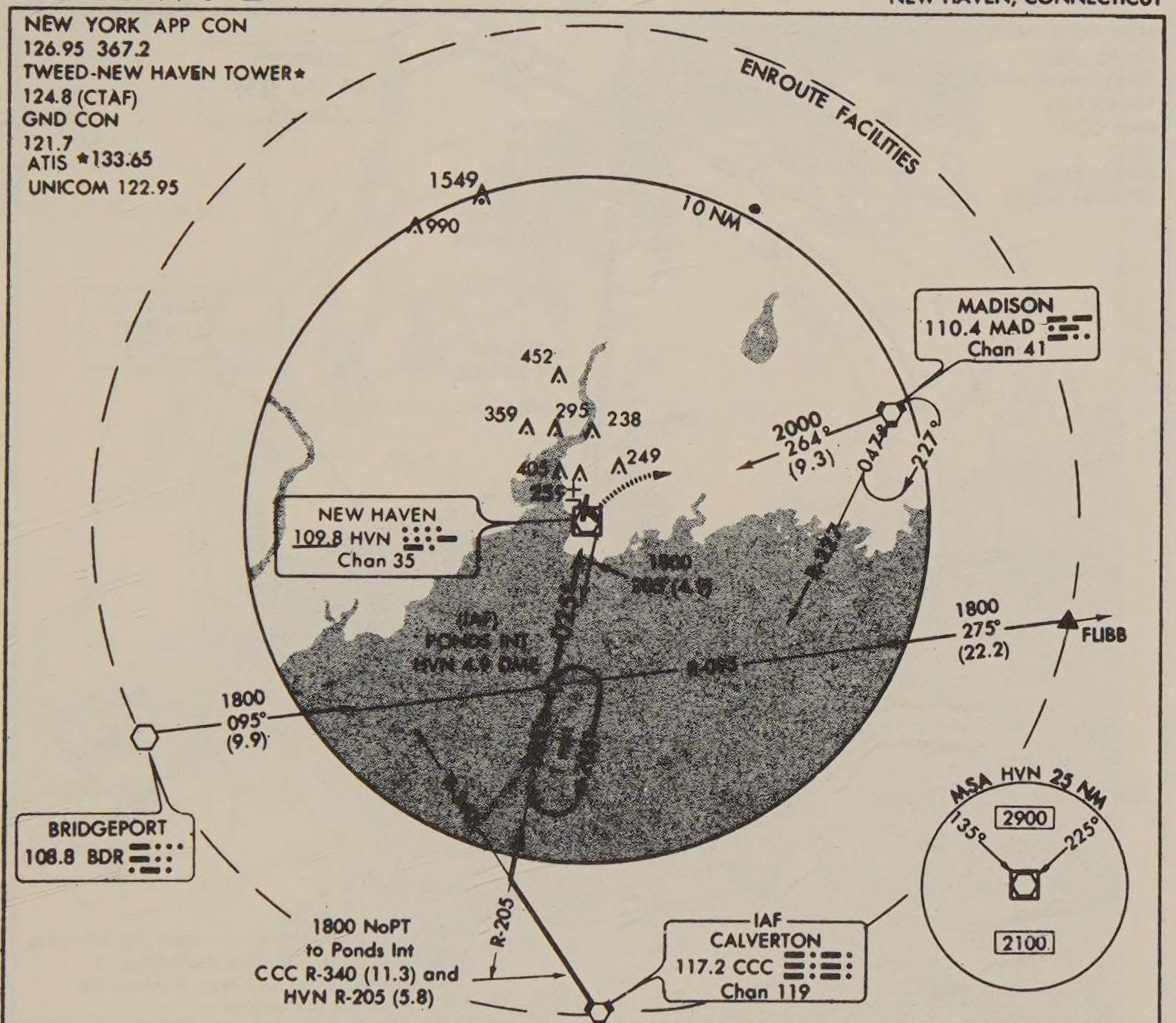
NAPA, CALIFORNIA
NAPA COUNTY (APC)

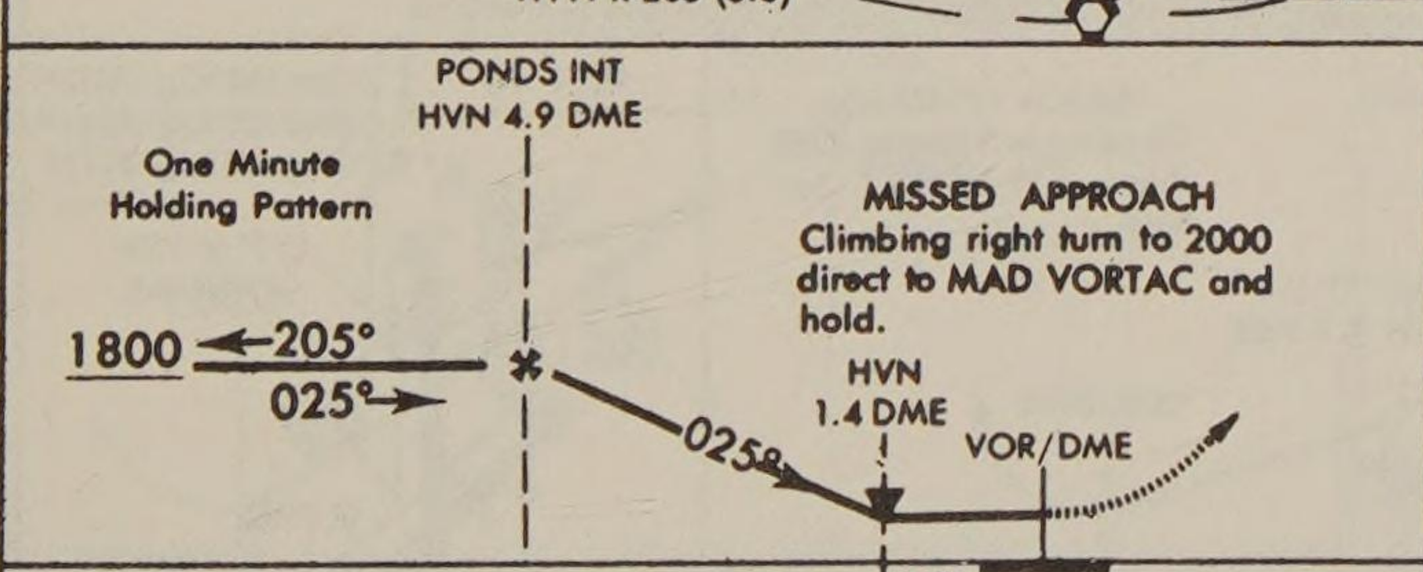
Not for use in Navigation

Amdt 19

VOR RWY 2

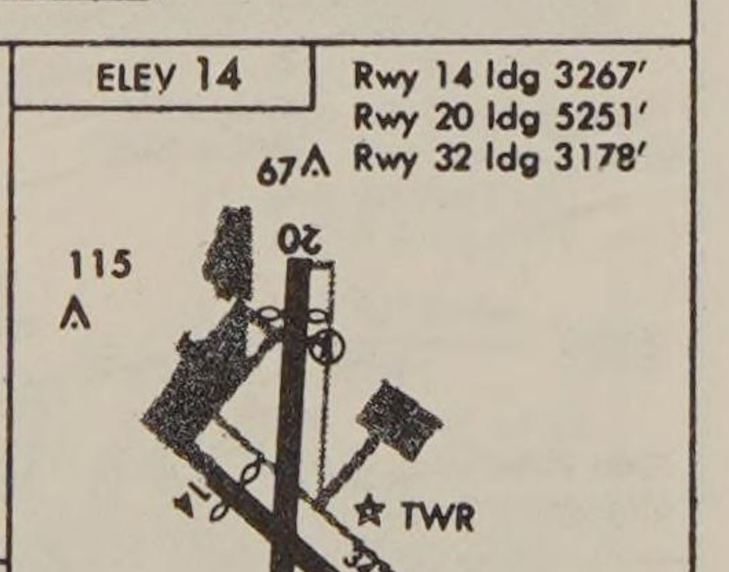
NEW HAVEN/TWEED-NEW HAVEN (HVN)
NEW HAVEN, CONNECTICUT





CATEGORY	A	B	C	D
S-2	380-¾ 372 (400-¾)			380-1¼ 372 (400-1¼)
CIRCLING	720-1 707 (800-1)		720-2 707 (800-2)	720-2¼ 707 (800-2¼)

ACTIVATE MALSF Rwy 2, HIRL Rwy 2-20 and MIRL Rwy 14-32-124.8.
When control zone not in effect the following applies: 1. Use Islip altimeter setting. 2. Increase all MDAs 140 feet, 3. Alternate minimums not authorized.



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 2

41°16'N-72°53'W

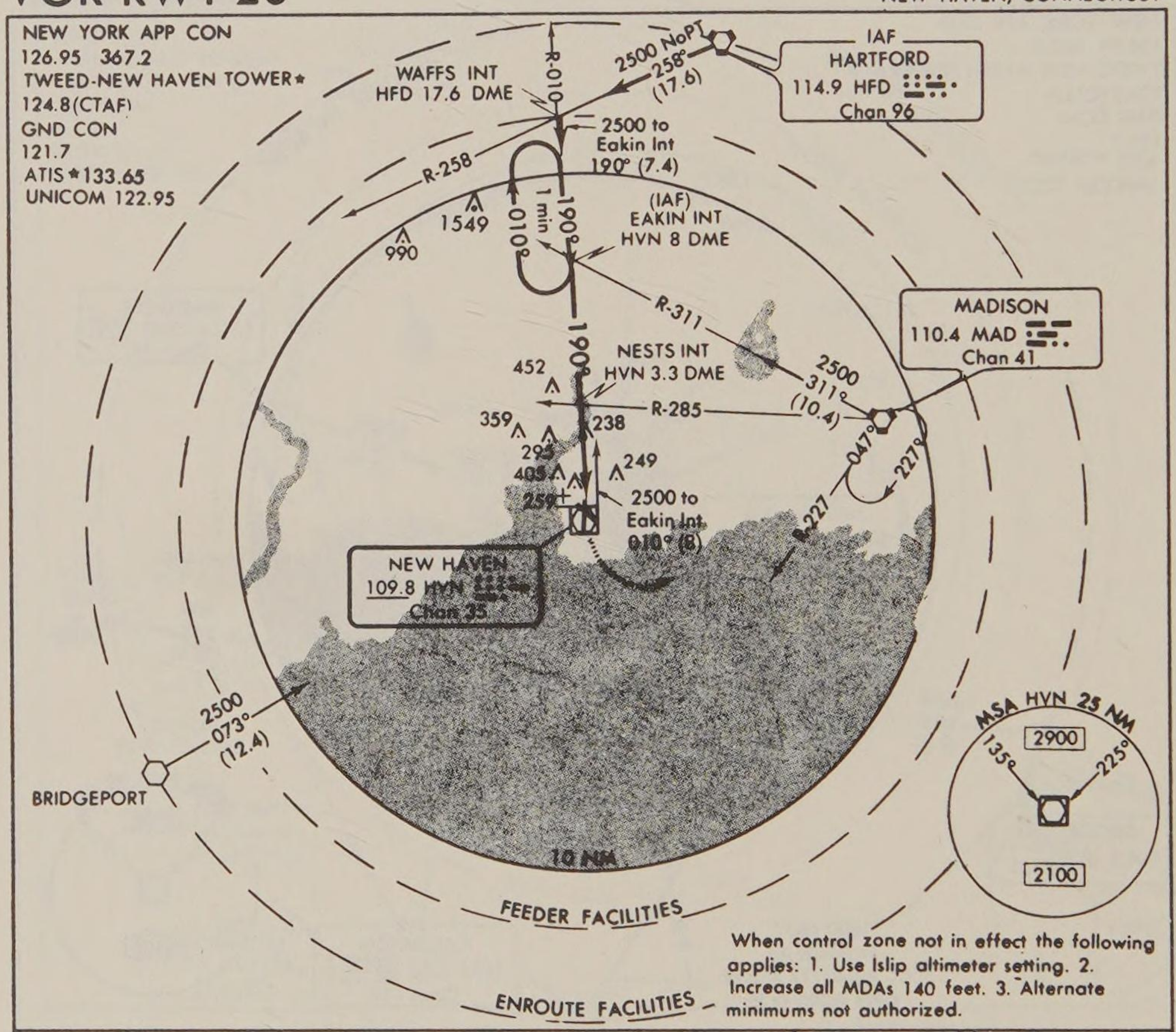
NEW HAVEN, CONNECTICUT
NEW HAVEN/TWEED-NEW HAVEN (HVN)

Not for use in Navigation

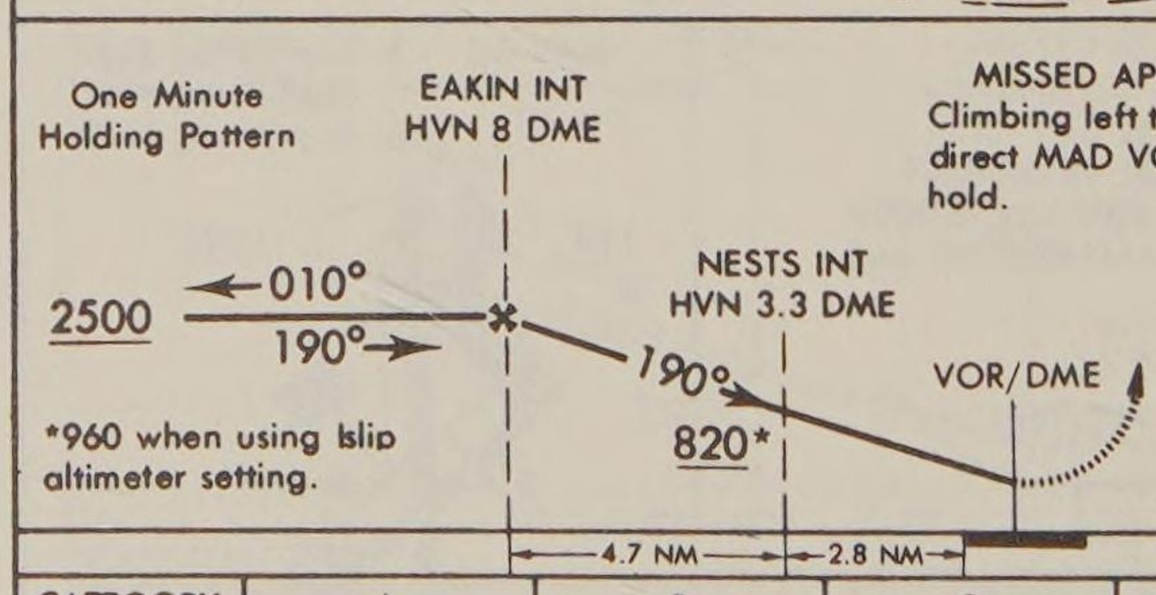
Amdt 4

VOR RWY 20

NEW HAVEN/TWEED-NEW HAVEN (HVN)
NEW HAVEN, CONNECTICUT

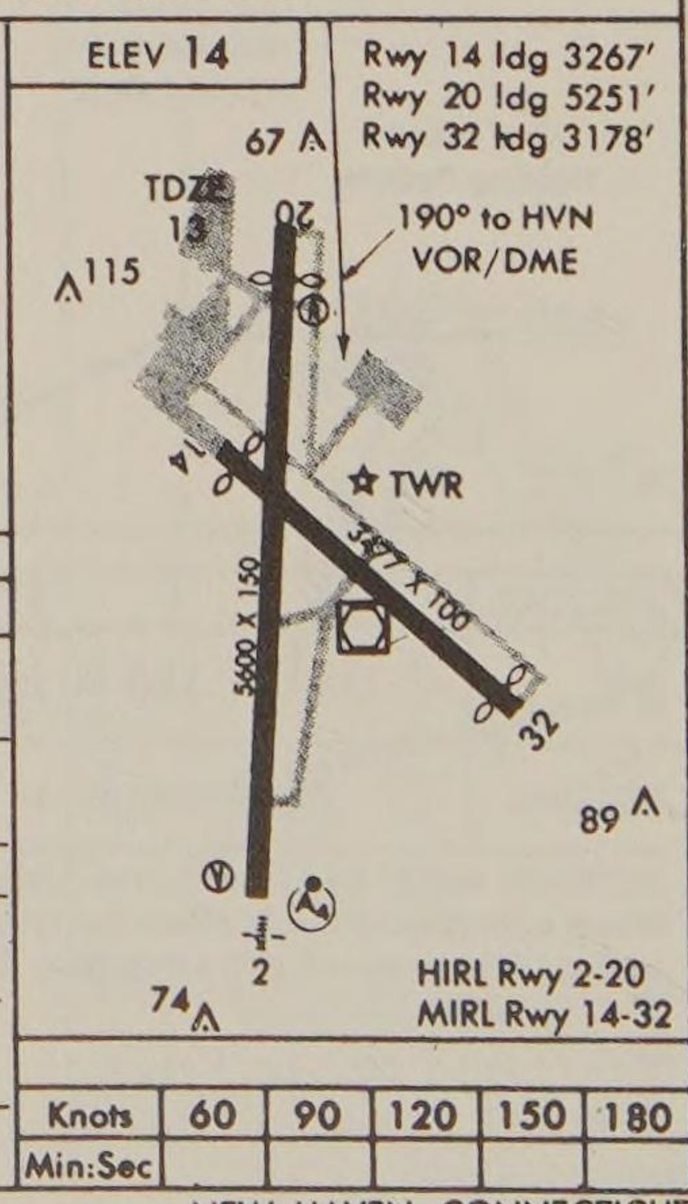


When control zone not in effect the following applies: 1. Use Islip altimeter setting. 2. Increase all MDAs 140 feet. 3. Alternate minimums not authorized.



CATEGORY	A	B	C	D
S-20	820-1 807 (900-1)	820-1¼ 807 (900-1¼)	820-2¼ 807 (900-2¼)	820-2½ 807 (900-2½)
CIRCLING	820-1 807 (900-1)	820-1¼ 807 (900-1¼)	820-2¼ 807 (900-2¼)	820-2½ 807 (900-2½)
DUAL VOR OR VOR/DME MINIMA				
S-20	660-1 647 (700-1)		660-1¾ 647 (700-1¾)	660-2 647 (700-2)
CIRCLING	720-1 707 (800-1)		720-2 707 (800-2)	720-2¼ 707 (800-2¼)

ACTIVATE MALSF Rwy 2, HIRL Rwy 2-20, and MIRL Rwy 14-32-124.8.



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 20

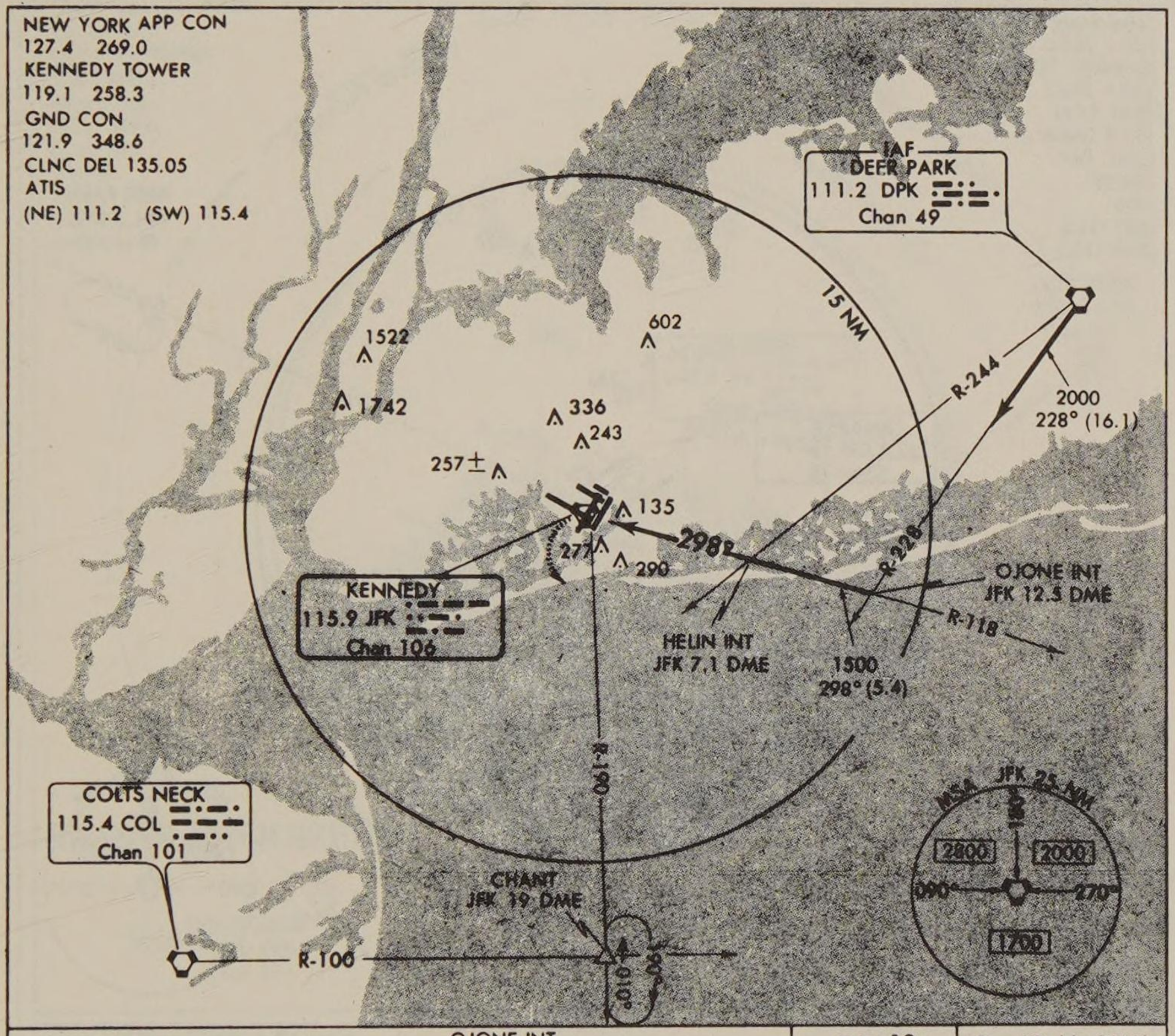
41°16'N – 72°53'W

NEW HAVEN, CONNECTICUT
NEW HAVEN/TWEED-NEW HAVEN (HVN)

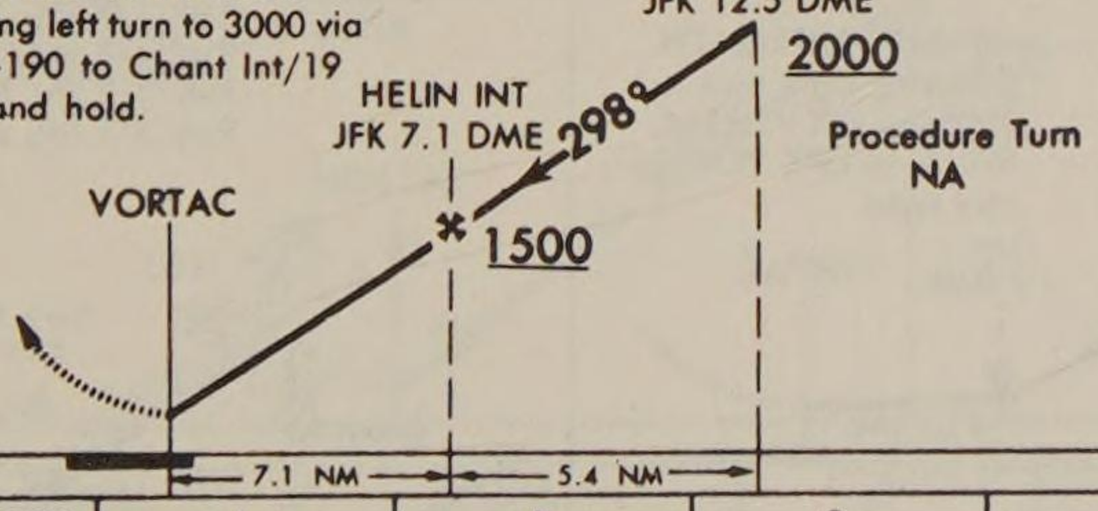
Not for use in Navigation

Amdt 8
VOR-D

NEW YORK/JOHN F. KENNEDY INTL (JFK)
NEW YORK, NEW YORK



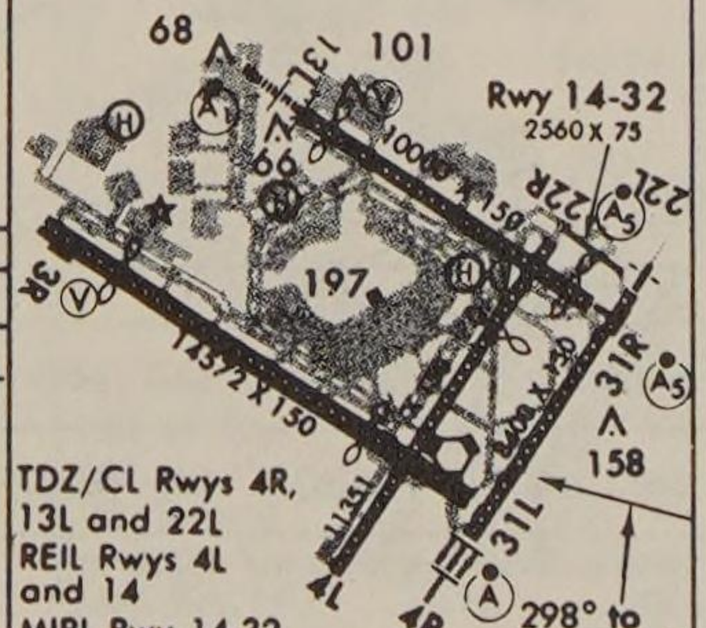
MISSED APPROACH
Climbing left turn to 3000 via JFK R-190 to Chant Int/19 DME and hold.



CATEGORY	A	B	C	D
CIRCLING	1000-3 987 (1000-3)			

ELEV 13

Rwy 13L ldg 9010'
Rwy 13R ldg 11966'
Rwy 22R ldg 8342'
Rwy 31L ldg 11248'
Rwy 31R ldg 8976'



TDZ/CL Rwys 4R, 13L and 22L
REIL Rwys 4L and 14
MIRL Rwy 14-32
HIRL Rwys 4L-22R, 4R-22L, 13R-31L, and 13L-31R

Knots	60	90	120	150	180
Min:Sec					

VOR-D

40°38'N – 73°46'W
185

NEW YORK, NEW YORK
NEW YORK/JOHN F. KENNEDY INTL (JFK)

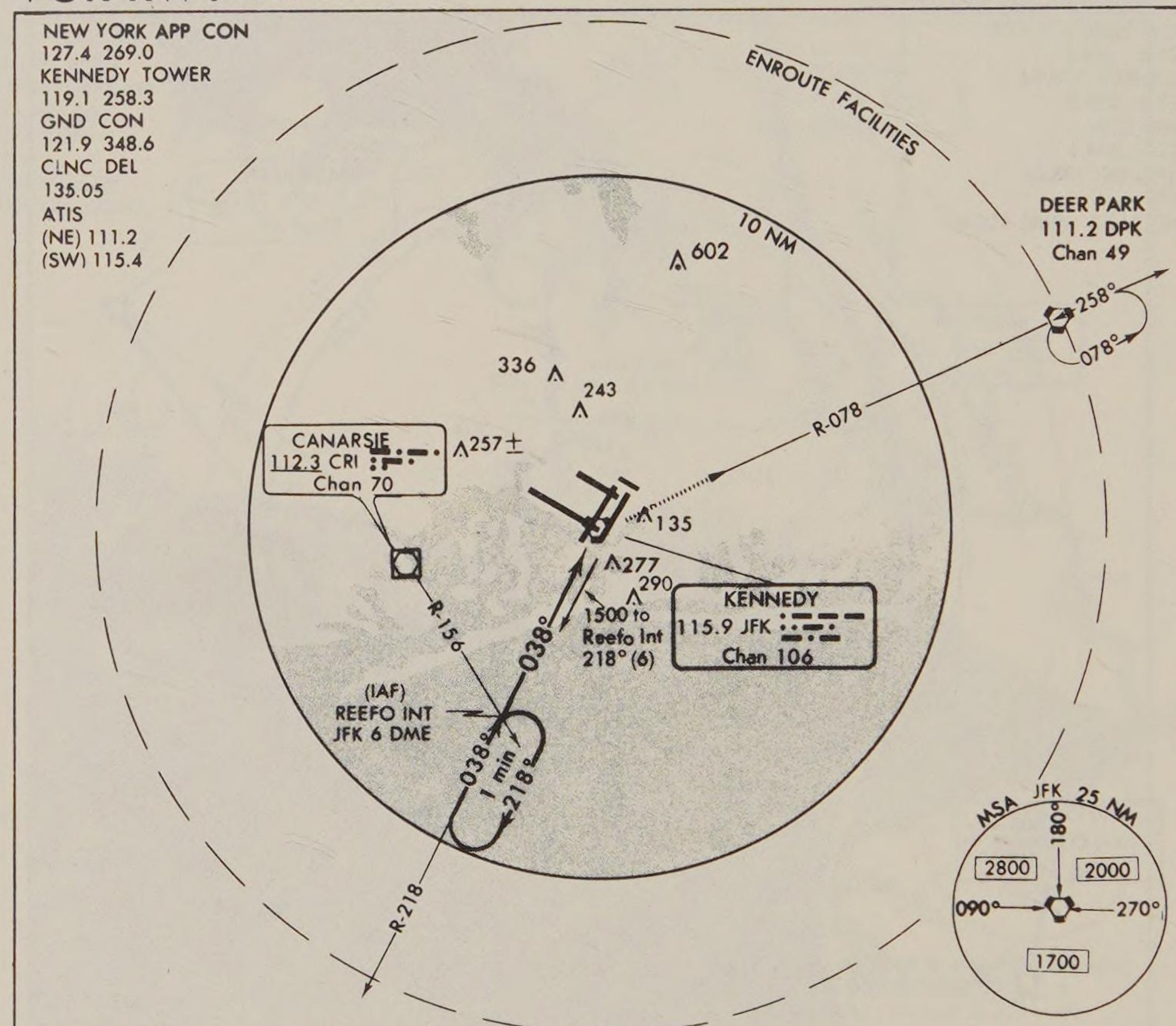
Not for use in Navigation

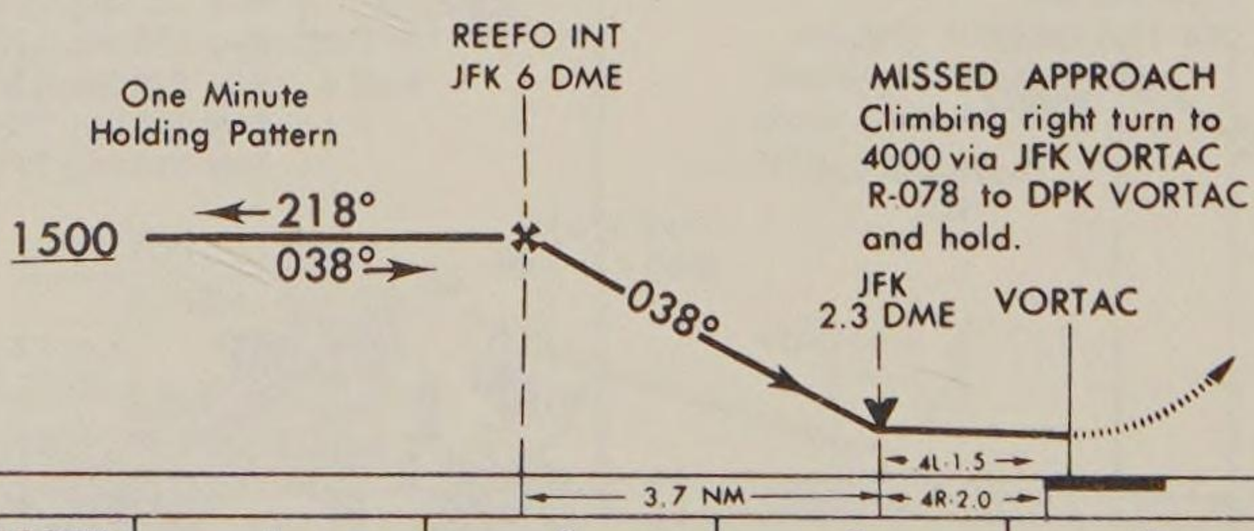
Amdt 14

VOR RWY 4L/R

NEW YORK/JOHN F. KENNEDY INTL (JFK)
NEW YORK, NEW YORK

NEW YORK APP CON
127.4 269.0
KENNEDY TOWER
119.1 258.3
GND CON
121.9 348.6
CLNC DEL
135.05
ATIS
(NE) 111.2
(SW) 115.4



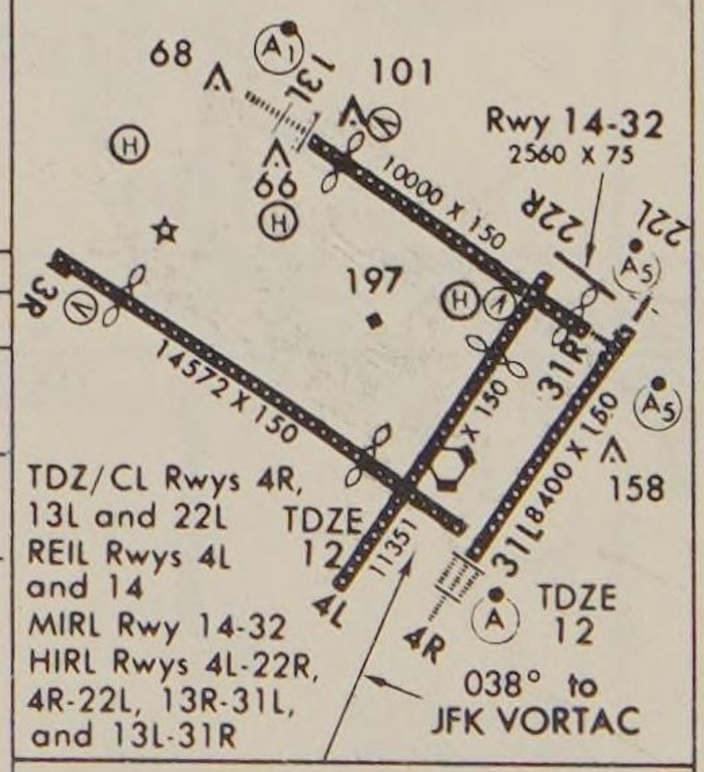


CATEGORY	A	B	C	D
S-4L/R	580/50 568 (600-1)		580-1½ 568 (600-1½)	580-1¾ 568 (600-1¾)
CIRCLING	580-1 568 (600-1)		580-1½ 568 (600-1½)	600-2 588 (600-2)

Inoperative table does not apply.

ELEV 13

Rwy 13L ldg 9010′
Rwy 13R ldg 11966′
Rwy 22R ldg 8342′
Rwy 31L ldg 11248′
Rwy 31R ldg 8976′



Knots	60	90	100	150	180
Min:Sec					

VOR RWY 4L/R

40° 38′N-73° 46′W

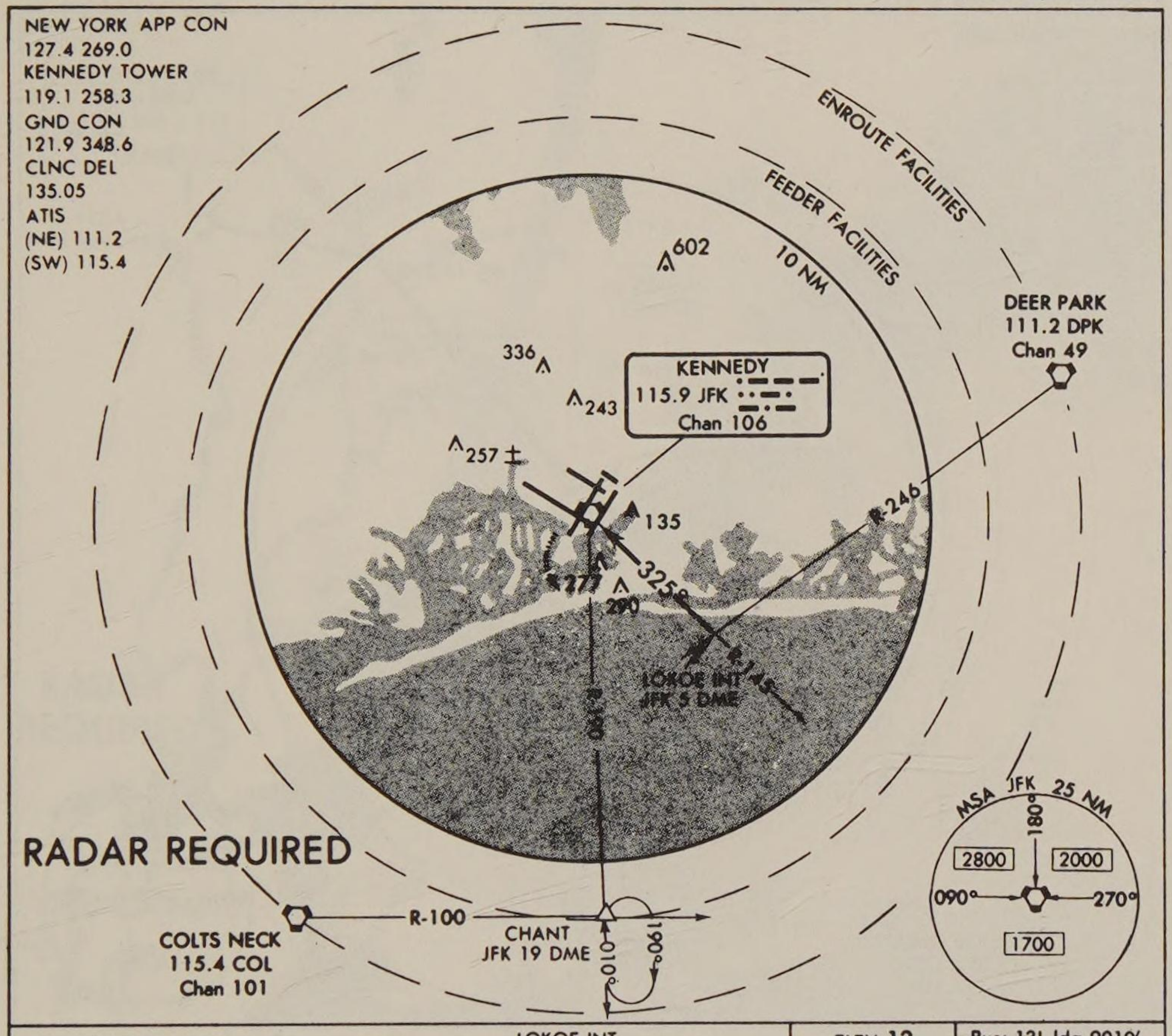
NEW YORK, NEW YORK
NEW YORK/JOHN F. KENNEDY INTL (JFK)

Not for use in Navigation

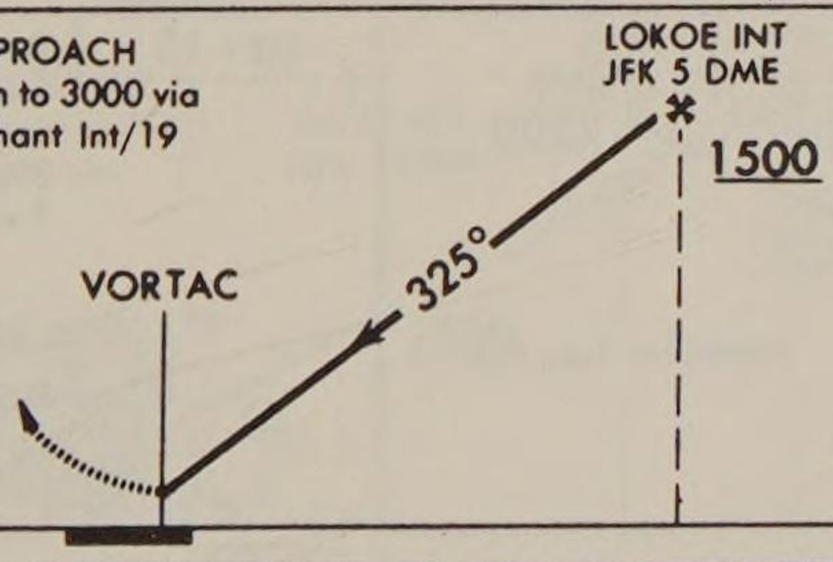
Amdt 10

VOR RWY 31L

NEW YORK/JOHN F. KENNEDY INTL (JFK)
NEW YORK, NEW YORK



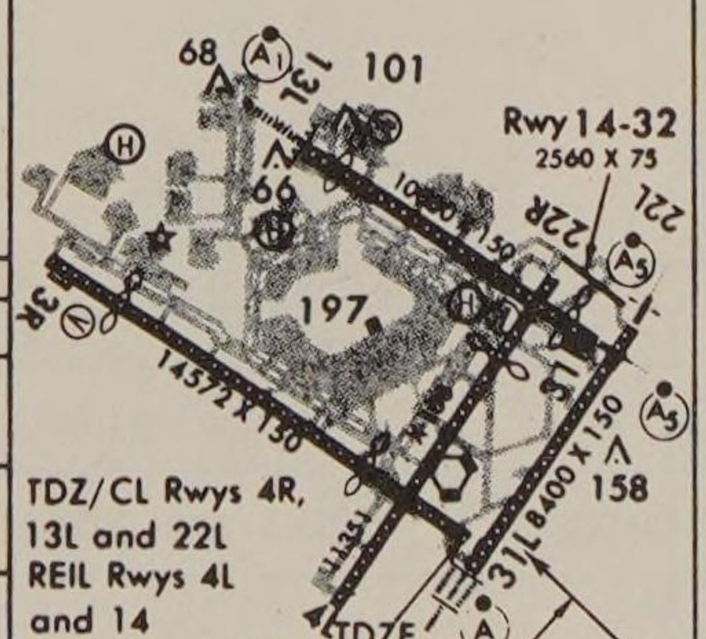
MISSED APPROACH
Climbing left turn to 3000 via JFK R-190 to Chant Int/19 DME and hold.



CATEGORY	A	B	C	D
S-31L	700-1½	688 (700-1½)	700-2 688 (700-2)	700-2¼ 688 (700-2¼)
CIRCLING	700-1½	688 (700-1½)	700-2 688 (700-2)	700-2¼ 688 (700-2¼)

ELEV 13

Rwy 13L ldg 9010'
Rwy 13R ldg 11966'
Rwy 22R ldg 8342'
Rwy 31L ldg 11248'
Rwy 31R ldg 8976'



TDZ/CL Rwys 4R, 13L and 22L
REIL Rwys 4L and 14
MIRL Rwy 14-32
HIRL Rwys 4L-22R, 4R-22L, 13R-31L, and 13L-31R

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 31L

40° 38'N-73° 46'W

NEW YORK, NEW YORK
NEW YORK/JOHN F. KENNEDY INTL (JFK)

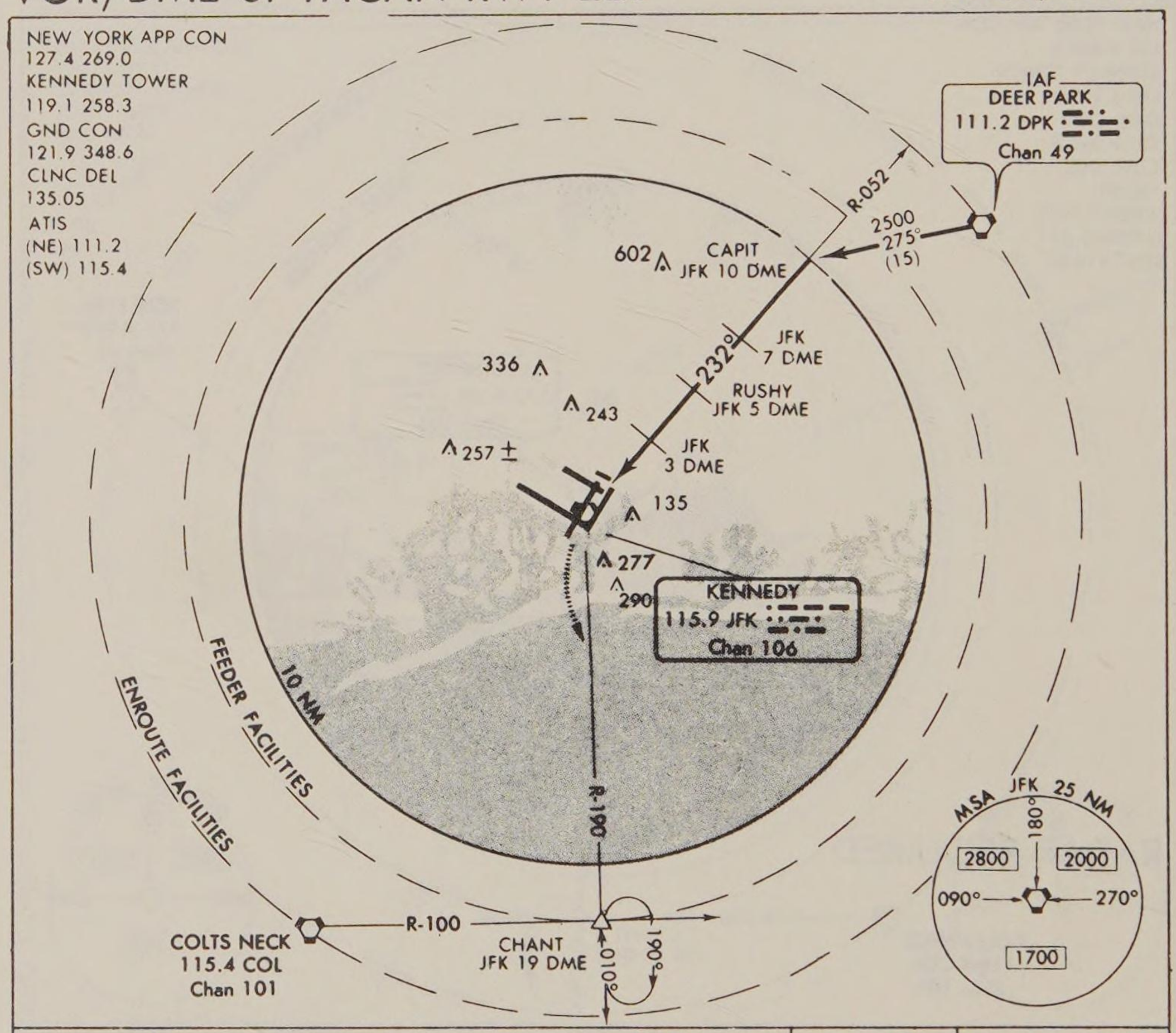
Not for use in Navigation

Amdt 3

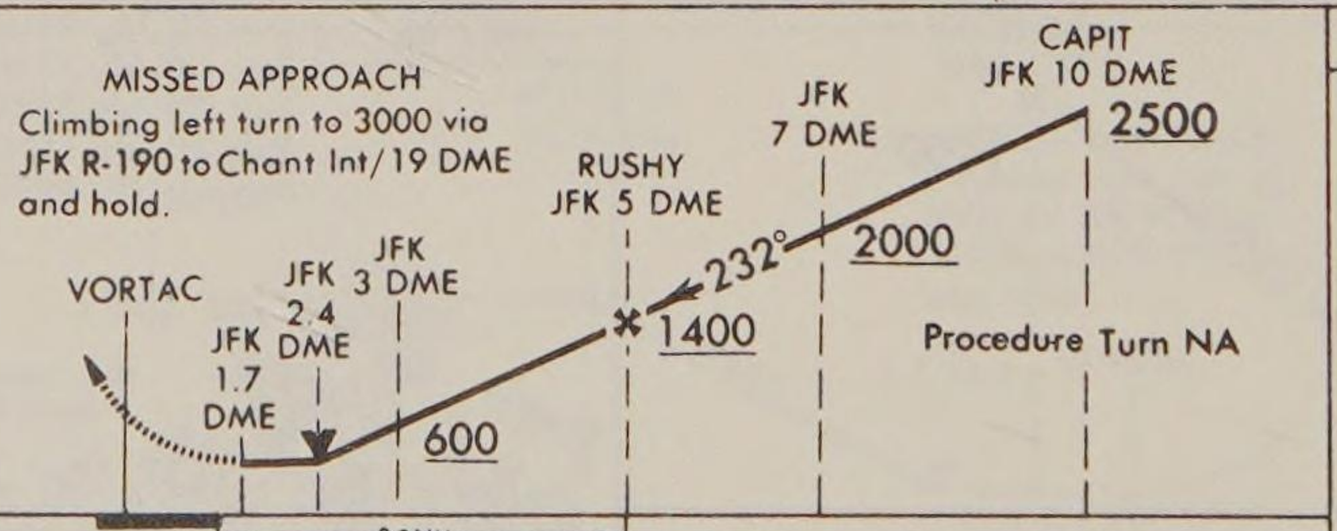
VOR/DME or TACAN RWY 22L

NEW YORK/JOHN F. KENNEDY INTL (JFK)
NEW YORK, NEW YORK

NEW YORK APP CON
127.4 269.0
KENNEDY TOWER
119.1 258.3
GND CON
121.9 348.6
CLNC DEL
135.05
ATIS
(NE) 111.2
(SW) 115.4



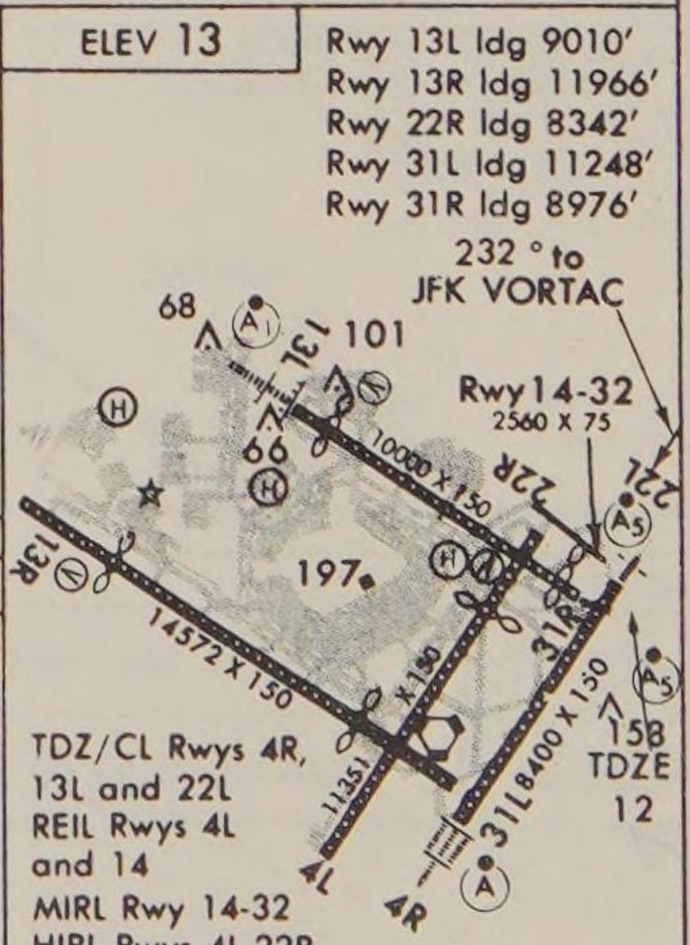
MISSED APPROACH
Climbing left turn to 3000 via JFK R-190 to Chant Int/19 DME and hold.



CATEGORY	A	B	C	D
S-22L	440/24 428 (500-½)		440/40 428 (500-¾)	440/50 428 (500-1)
CIRCLING	580-1 568 (600-1)		580-1½ 568 (600-1½)	600-2 588 (600-2)

ELEV 13

Rwy 13L ldg 9010'
Rwy 13R ldg 11966'
Rwy 22R ldg 8342'
Rwy 31L ldg 11248'
Rwy 31R ldg 8976'



TDZ/CL Rwys 4R, 13L and 22L
REIL Rwys 4L and 14
MIRL Rwy 14-32
HIRL Rwys 4L-22R, 4R-22L, 13R-31L, and 13L-31R

Knots	60	90	120	150	180
Min:Sec					

VOR/DME or TACAN RWY 22L

NEW YORK/JOHN F. KENNEDY INTL (JFK)
NEW YORK, NEW YORK

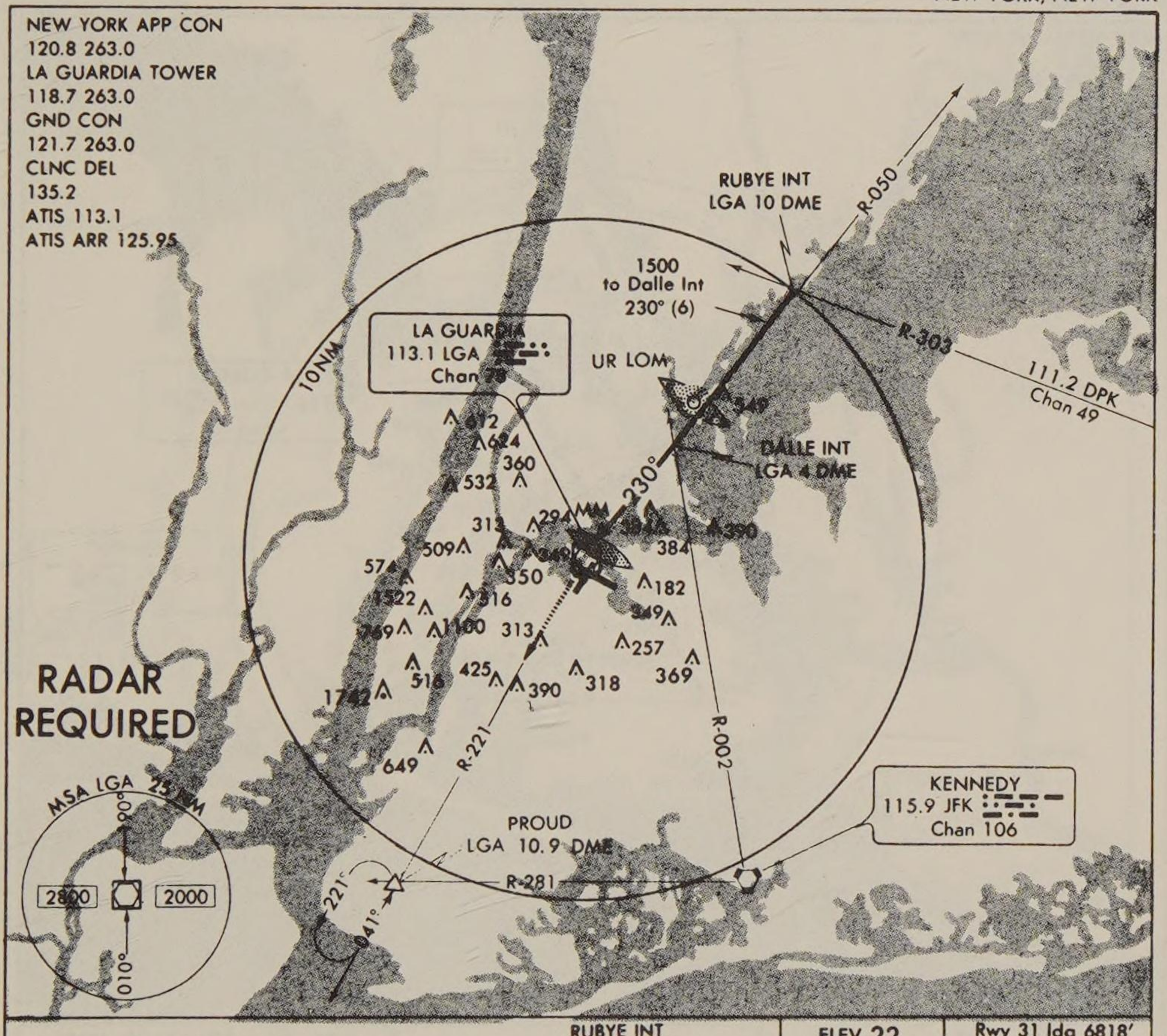
40° 38'N-73° 46'W

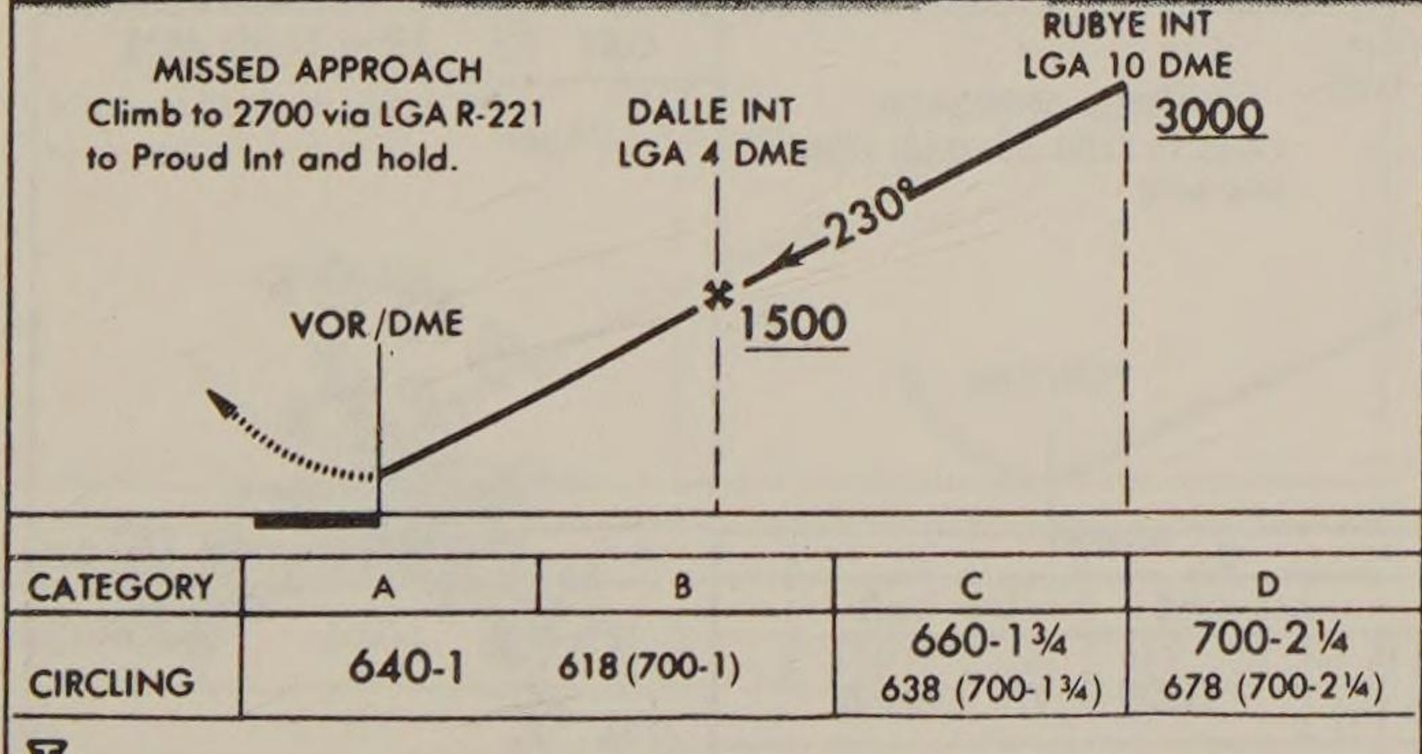
Not for use in Navigation

Amdt 12

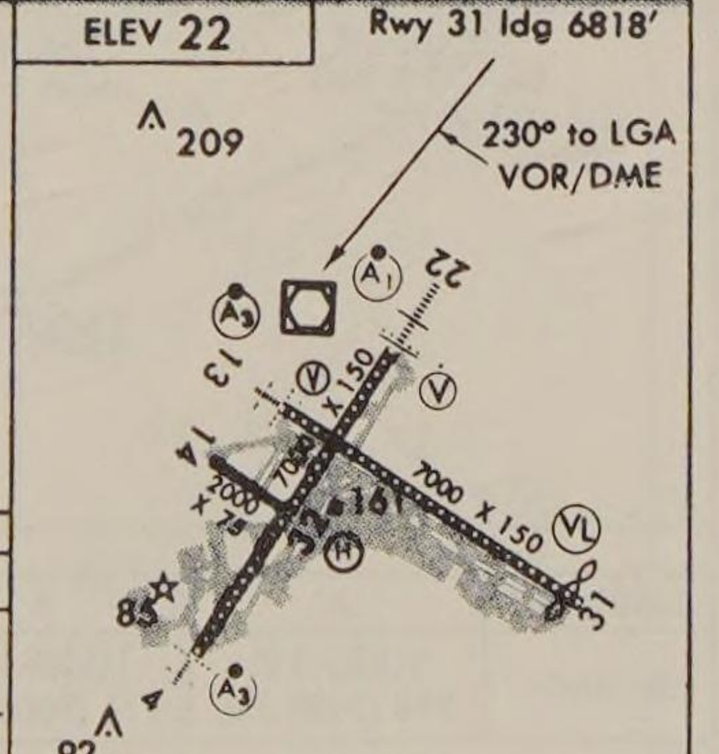
VOR-A

NEW YORK/LA GUARDIA (LGA)
NEW YORK, NEW YORK





CATEGORY	A	B	C	D
CIRCLING	640-1	618 (700-1)	660-1¾ 638 (700-1¾)	700-2¼ 678 (700-2¼)



TDZ/CL Rwy 22
HIRL Rwys 4-22 and 13-31
REIL Rwys 13, 22 and 31

Knots	60	90	120	150	180
Min:Sec					

VOR-A

40°46'N-73°52'W

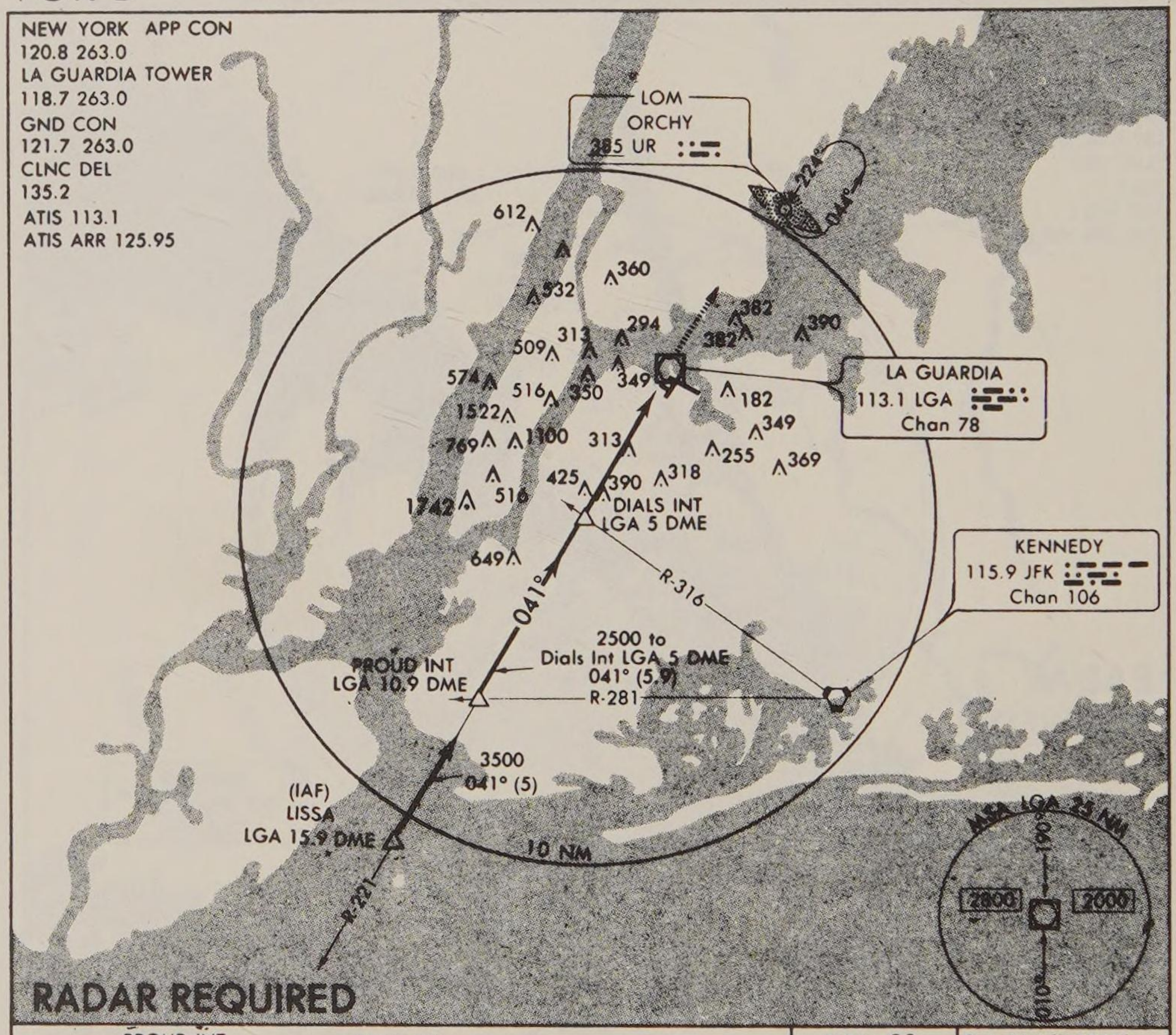
NEW YORK, NEW YORK
NEW YORK/LA GUARDIA (LGA)

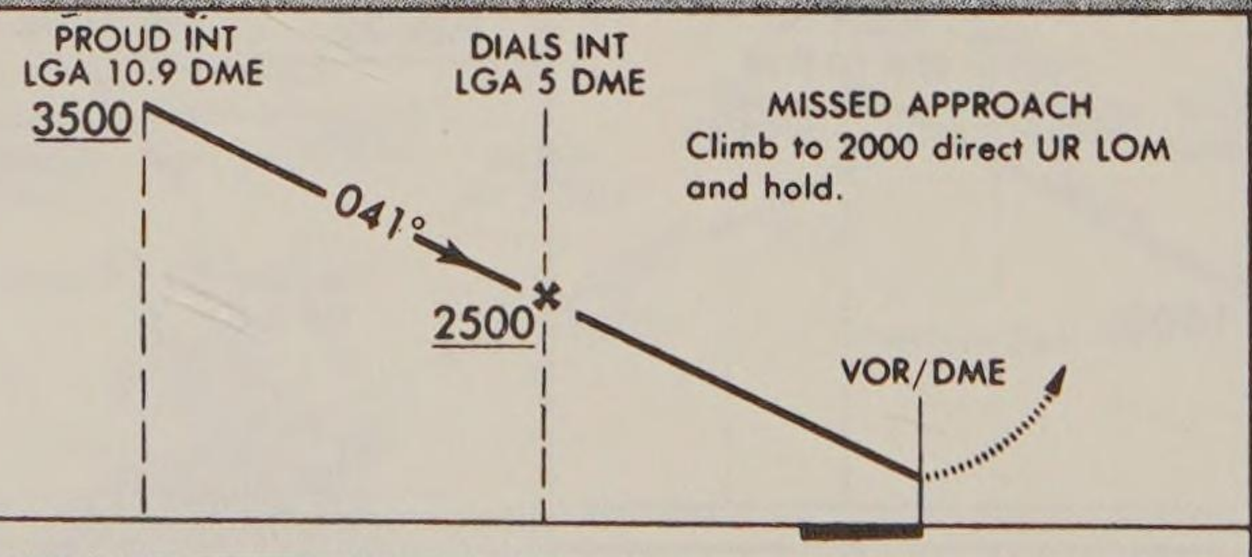
Not for use in Navigation

Amdt 1
VOR-B

NEW YORK/LA GUARDIA (LGA)
NEW YORK, NEW YORK

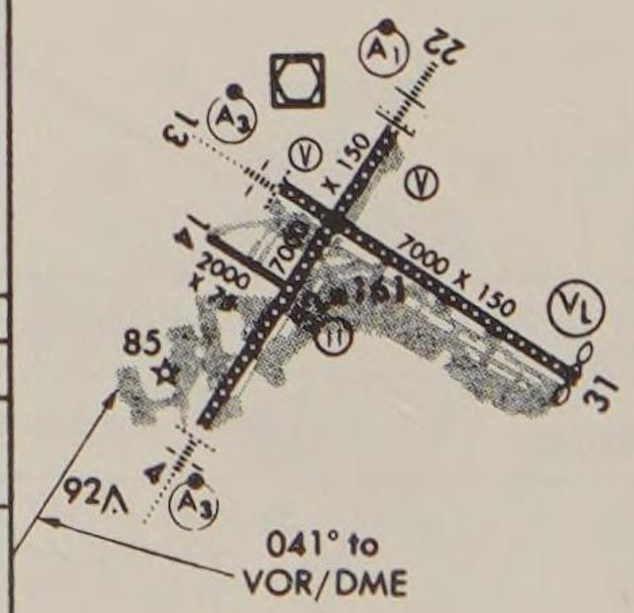
NEW YORK APP CON
120.8 263.0
LA GUARDIA TOWER
118.7 263.0
GND CON
121.7 263.0
CLNC DEL
135.2
ATIS 113.1
ATIS ARR 125.95





MISSED APPROACH
Climb to 2000 direct UR LOM and hold.

ELEV 22 | Rwy 31 ldg 6818'



TDZ/CL Rwy 22
HIRL Rwys 4-22 and 13-31
REIL Rwys 13, 22 and 31

CATEGORY	A	B	C	D
CIRCLING	1000-1¼ 978 (1000-1¼)	1000-1½ 978 (1000-1½)	1000-3 978 (1000-3)	

Knots	60	90	120	150	180
Min:Sec					

VOR-B

40°46'N-73°52'W

NEW YORK, NEW YORK
NEW YORK/LA GUARDIA (LGA)

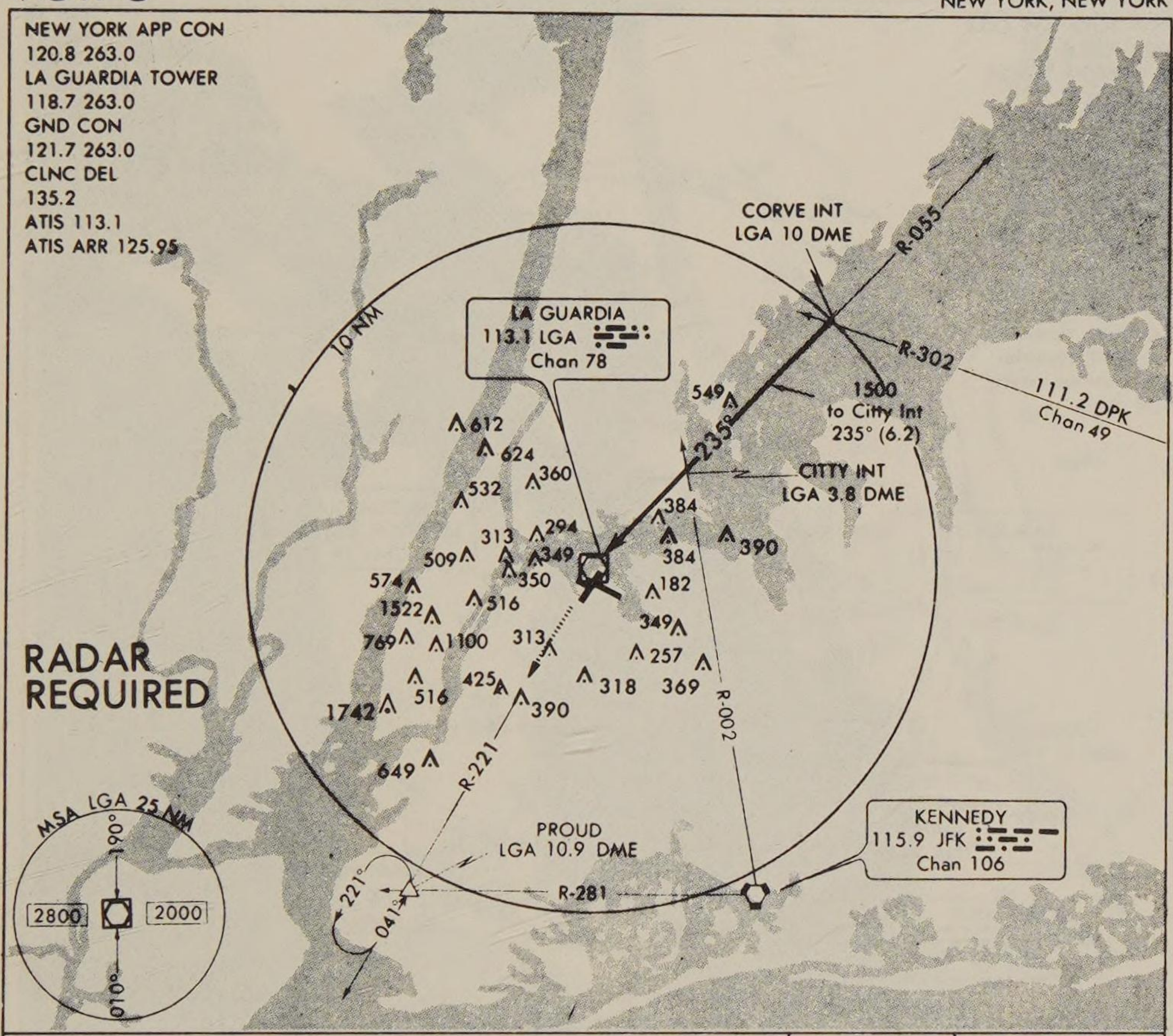
Not for use in Navigation

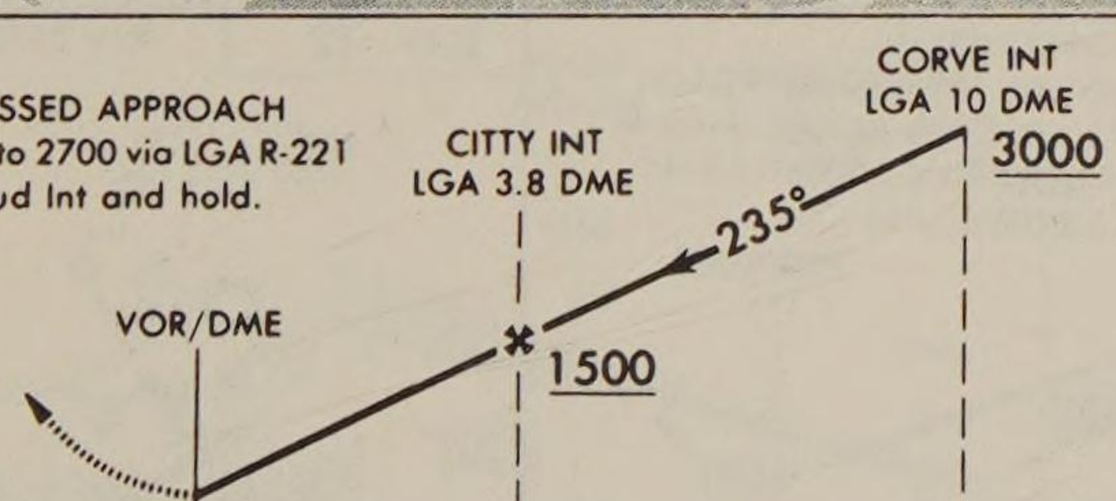
Amdt 5

VOR-C

NEW YORK/LA GUARDIA (LGA)

NEW YORK, NEW YORK





CATEGORY	A	B	C	D
CIRCLING	640-1	618 (700-1)	660-1¾ 638 (700-1¾)	700-2¼ 678 (700-2¼)

ELEV 22

Rwy 31 ldg 6818'

TDZ/CL Rwy 22
HIRL Rwys 4-22 and 13-31
REIL Rwys 13, 22 and 31

Knots	60	90	120	150	180
Min:Sec					

VOR-C

40°46'N-73°52'W

NEW YORK, NEW YORK
NEW YORK/LA GUARDIA (LGA)

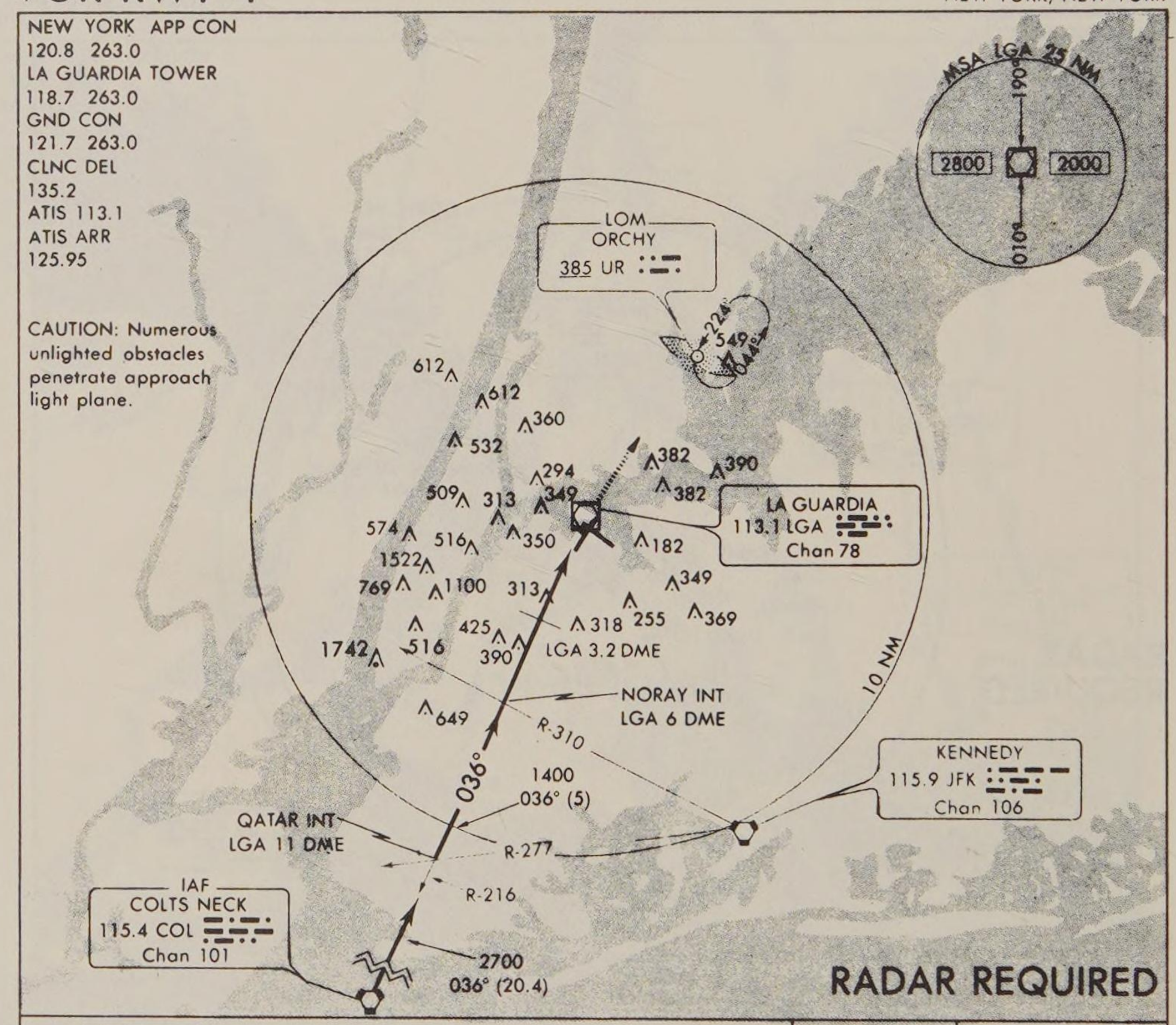
Not for use in Navigation

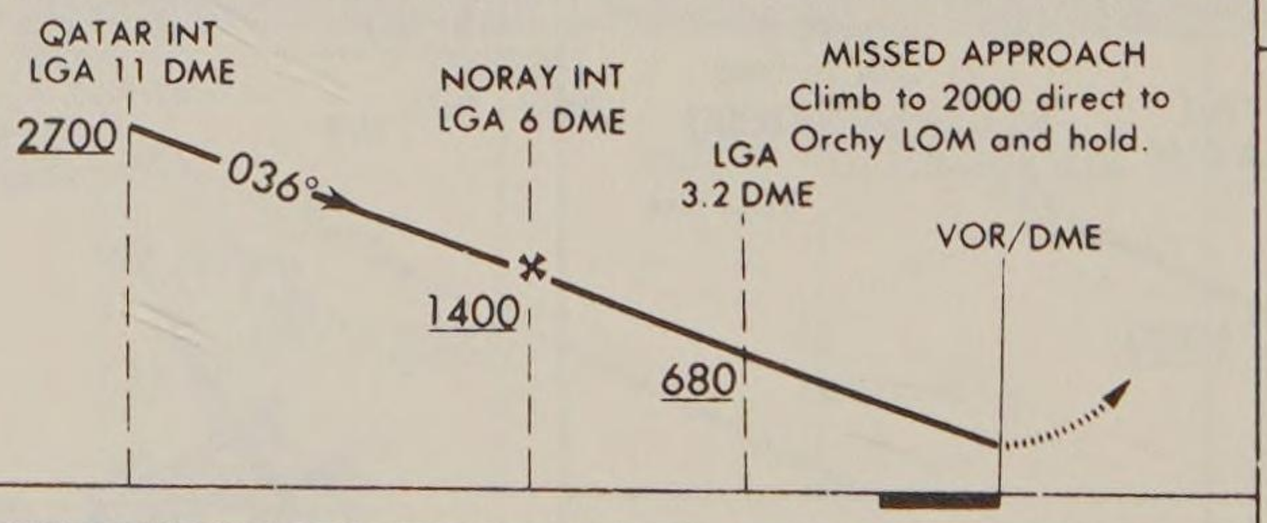
Orig

VOR RWY 4

NEW YORK/LA GUARDIA (LGA)

NEW YORK, NEW YORK



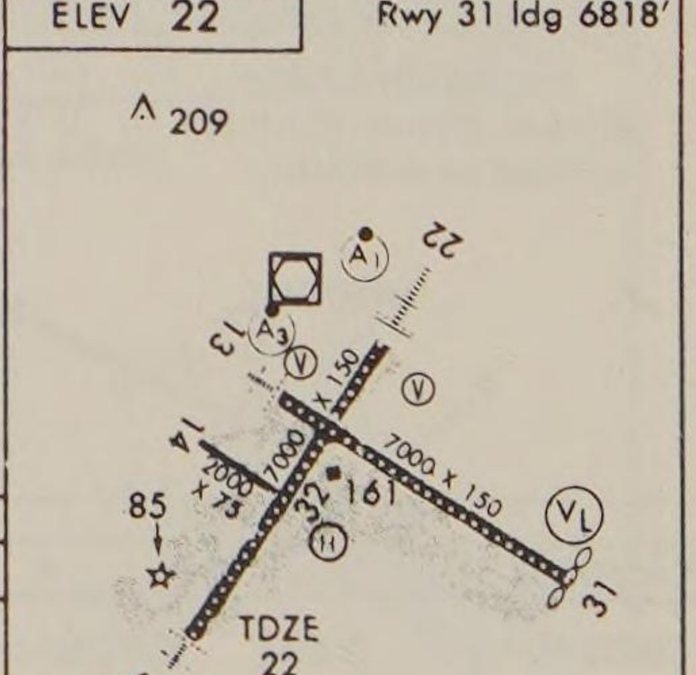


CATEGORY	A	B	C	D
S-4	680/50 658 (700-1)		680-1¾ 658 (700-1¾)	680-2 658 (700-2)
CIRCLING	680-1 658 (700-1)		680-1¾ 658 (700-1¾)	700-2¼ 678 (700-2¼)
VOR/DME MINIMA				
S-4	580/50 558 (600-1)		580-1½ 558 (600-1½)	580-1¾ 558 (600-1¾)
CIRCLING	580-1 558 (600-1)	620-1 598 (600-1)	620-1½ 598 (600-1½)	700-2¼ 678 (700-2¼)

Inoperative table does not apply. TA

ELEV 22

Rwy 31 ldg 6818'



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 4

40°46'N-73°52'W

NEW YORK, NEW YORK

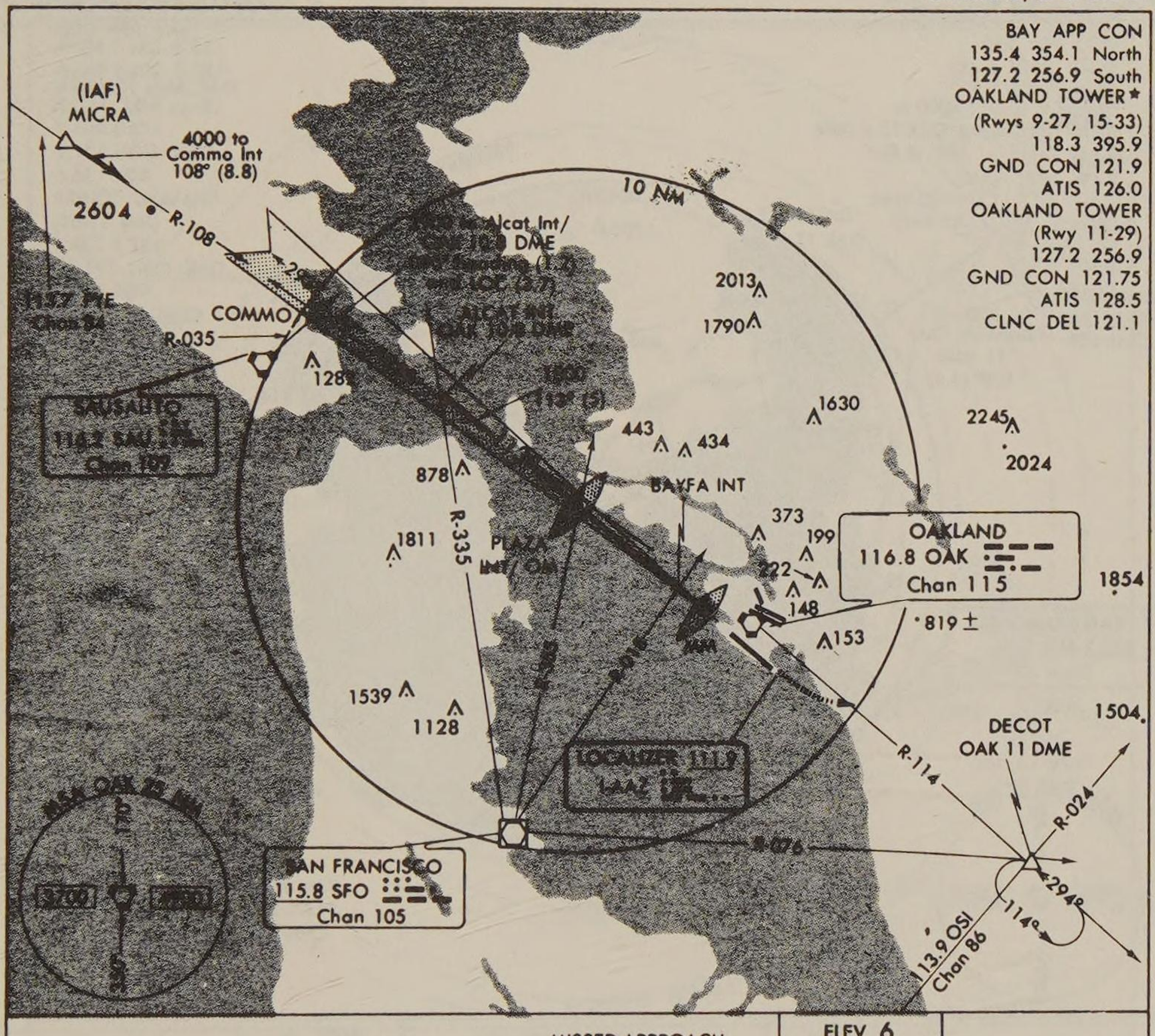
NEW YORK/LA GUARDIA (LGA)

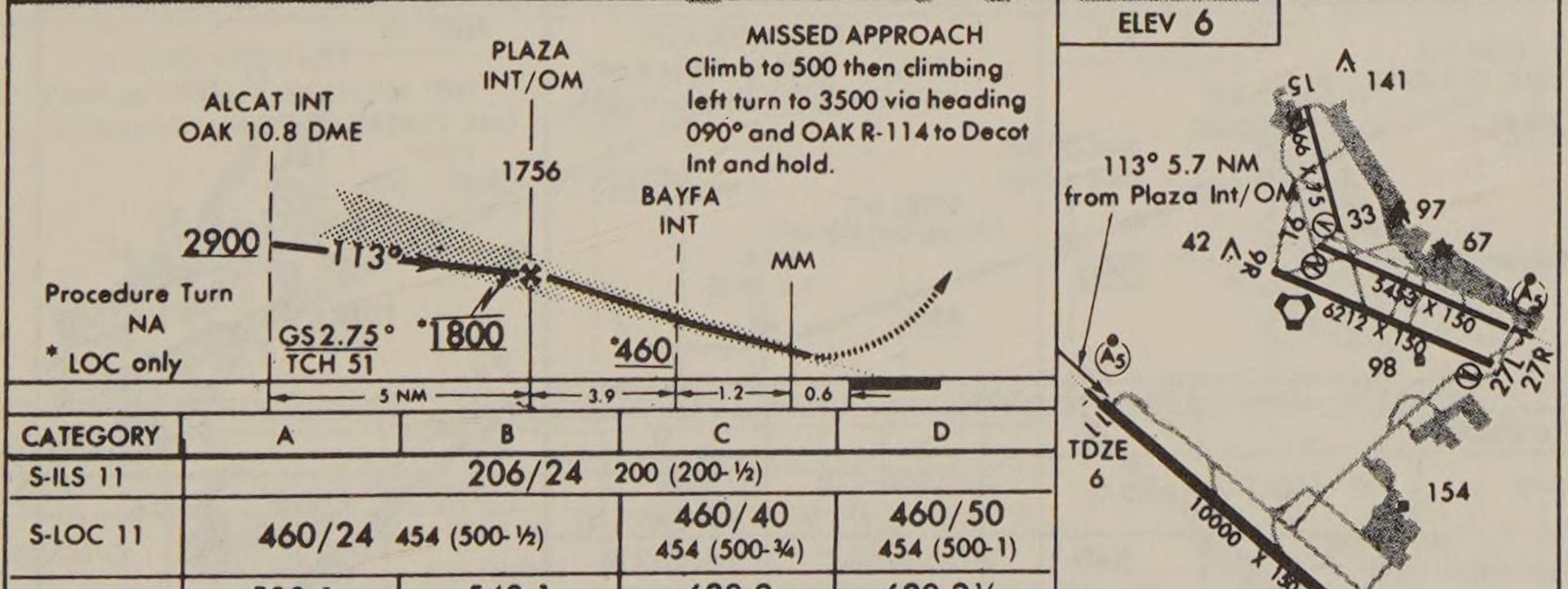
Not for use in Navigation

Amdt 3

ILS RWY 11

OAKLAND/METROPOLITAN OAKLAND INTL (OAK)
OAKLAND, CALIFORNIA





CATEGORY	A	B	C	D
S-ILS 11	206/24 200 (200-½)			
S-LOC 11	460/24 454 (500-½)		460/40 454 (500-¾)	460/50 454 (500-1)
CIRCLING	500-1 494 (500-1)	540-1 534 (600-1)	680-2 674 (700-2)	680-2¼ 674 (700-2¼)
LOC/VOR MINIMA				
S-LOC 11	300/24 294 (300-½)			300/40 294 (300-¾)

CAT D LOC./VOR visibility increased to RVR 5000 for inoperative MM or MALSR.

FAF to MAP 5.7 NM					
Knots	60	90	120	150	180
Min:Sec	5:42	3:48	2:51	2:17	1:54

ILS RWY 11

37°43'N-122°13'W

OAKLAND, CALIFORNIA
OAKLAND/METROPOLITAN OAKLAND INTL (OAK)

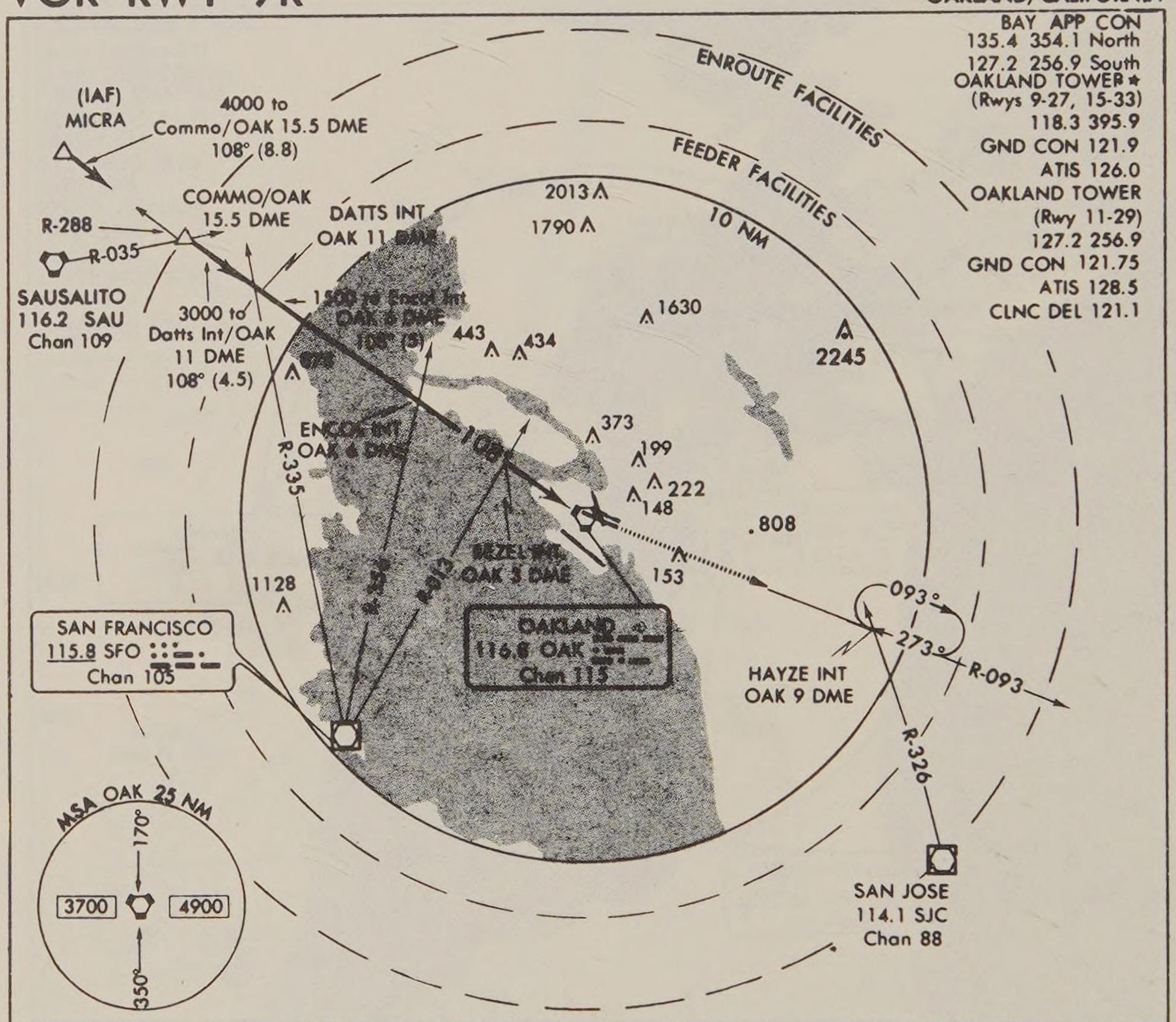
Not for use in Navigation

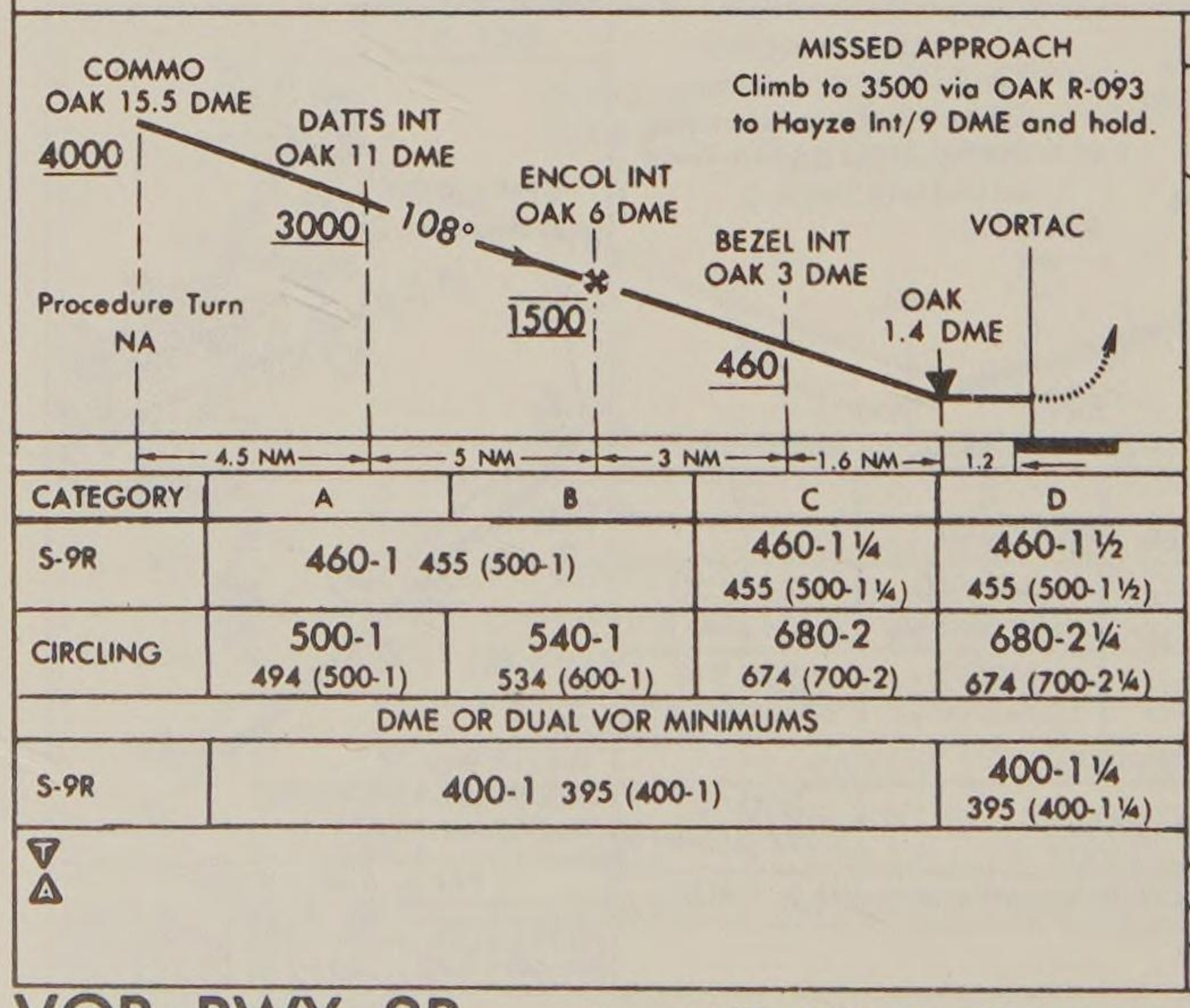
Amdt 5

VOR RWY 9R

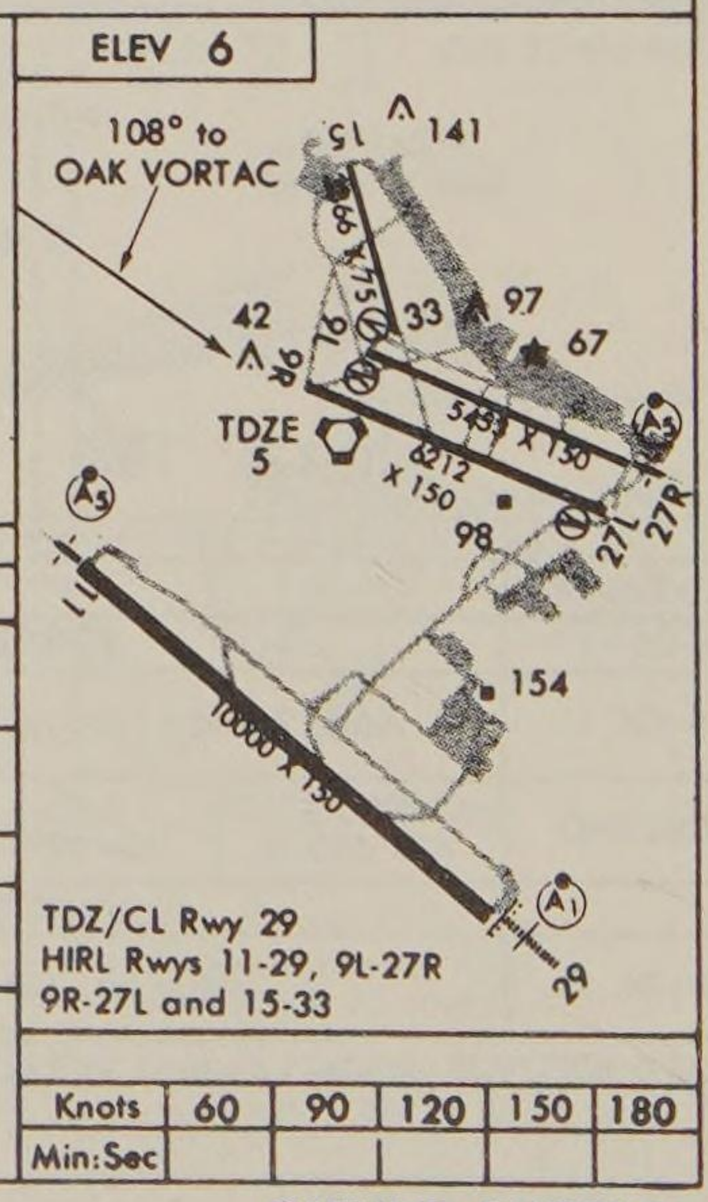
OAKLAND/METROPOLITAN OAKLAND INTL (OAK)

OAKLAND, CALIFORNIA





CATEGORY	A	B	C	D
S-9R	460-1 455 (500-1)		460-1¼ 455 (500-1¼)	460-1½ 455 (500-1½)
CIRCLING	500-1 494 (500-1)	540-1 534 (600-1)	680-2 674 (700-2)	680-2¼ 674 (700-2¼)
DME OR DUAL VOR MINIMUMS				
S-9R	400-1 395 (400-1)			400-1¼ 395 (400-1¼)



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 9R

37°43'N – 122°13'W

OAKLAND, CALIFORNIA

OAKLAND/METROPOLITAN OAKLAND INTL (OAK)

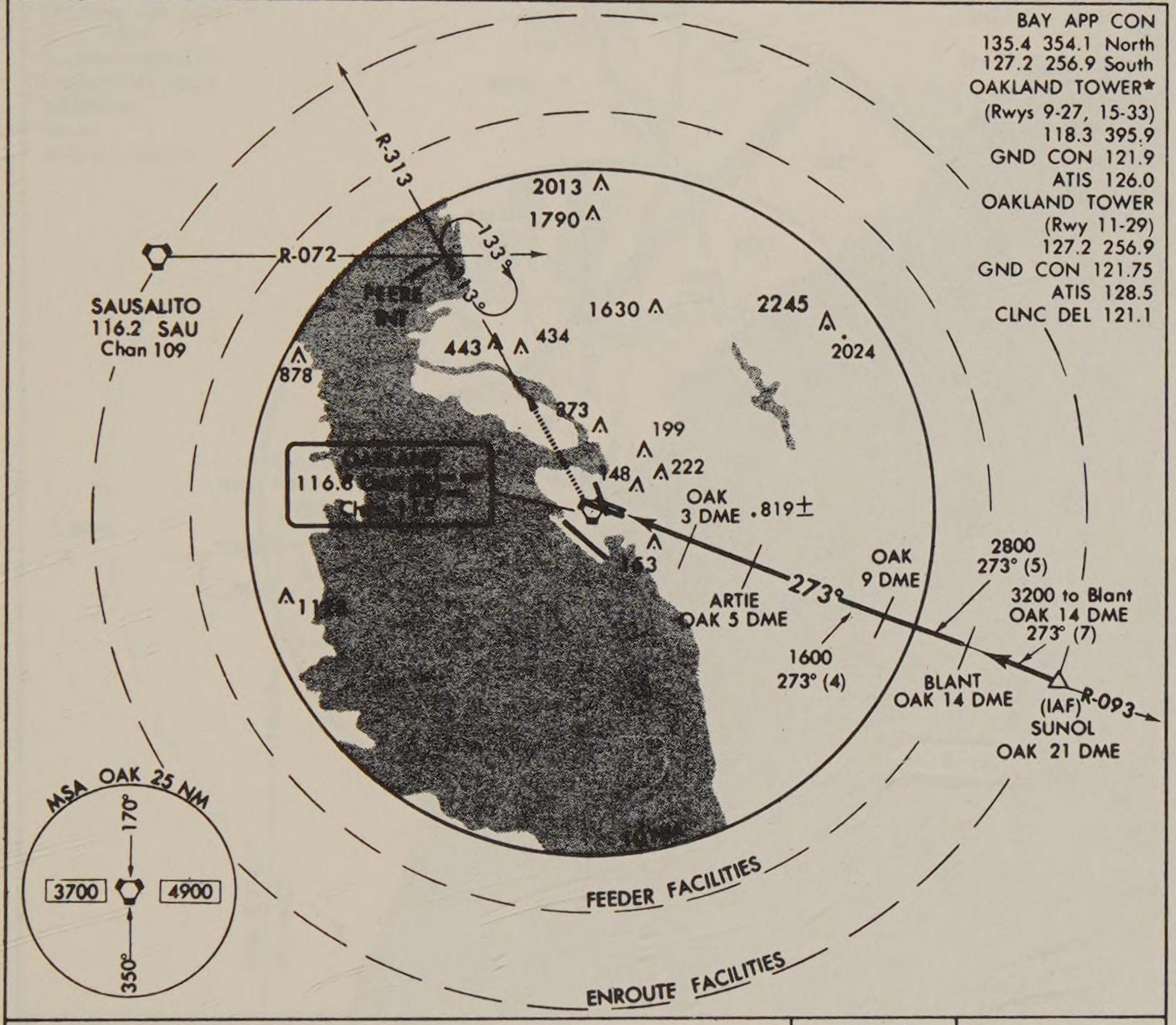
Not for use in Navigation

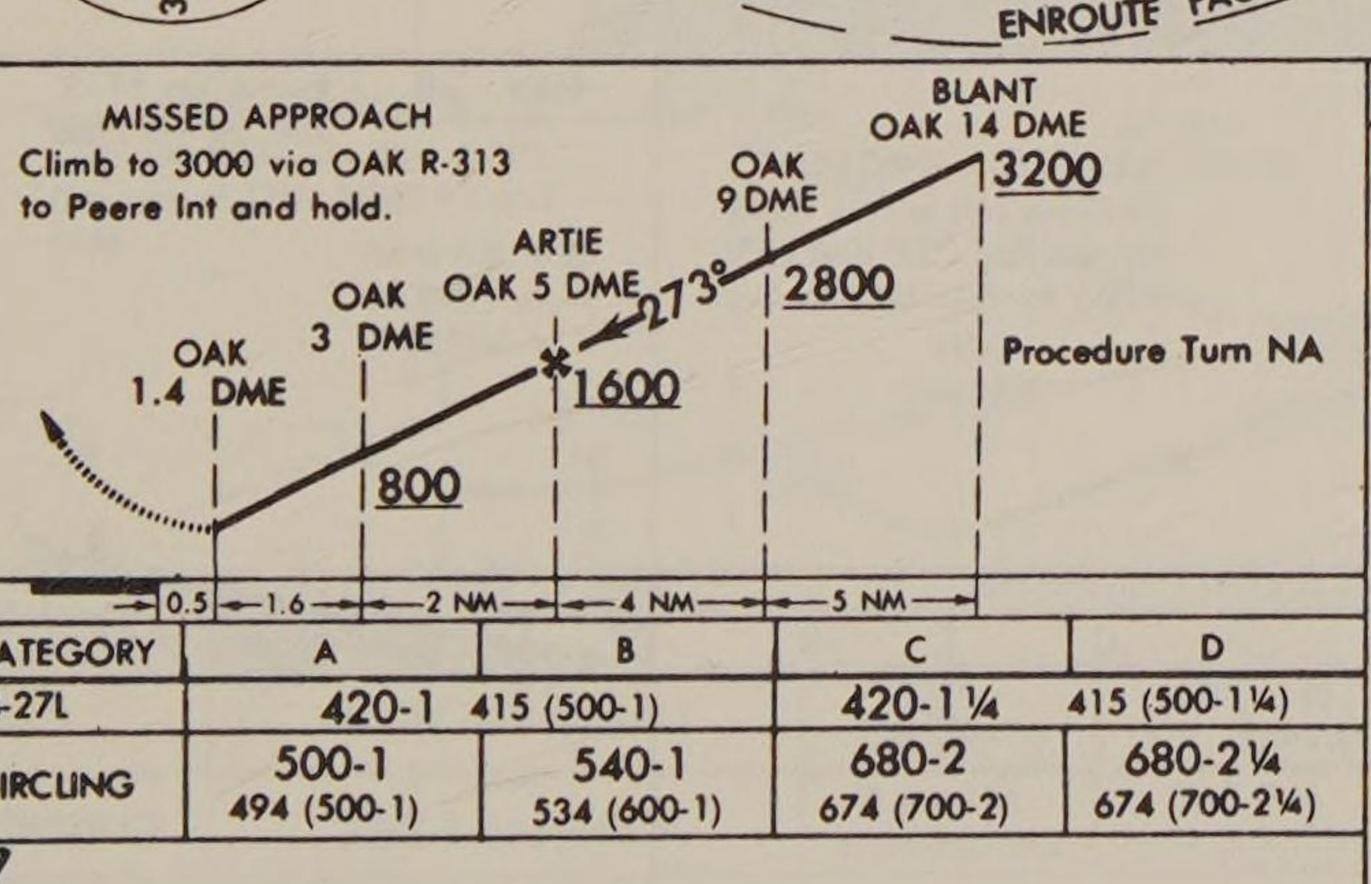
Amdt 10

VOR/DME RWY 27L

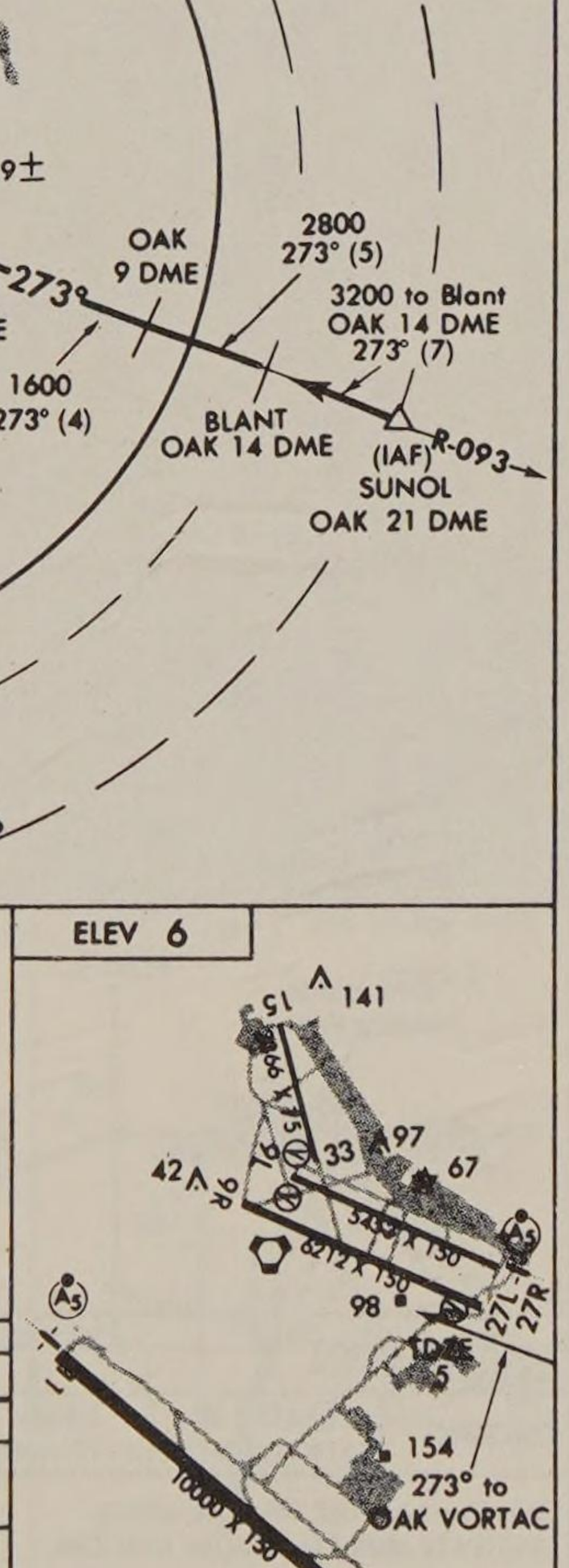
OAKLAND/METROPOLITAN OAKLAND INTL (OAK)

OAKLAND, CALIFORNIA





CATEGORY	A	B	C	D
S-27L	420-1 415 (500-1)		420-1¼ 415 (500-1¼)	
CIRCLING	500-1 494 (500-1)	540-1 534 (600-1)	680-2 674 (700-2)	680-2¼ 674 (700-2¼)



Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 27L

37°43'N – 122°13'W

OAKLAND, CALIFORNIA

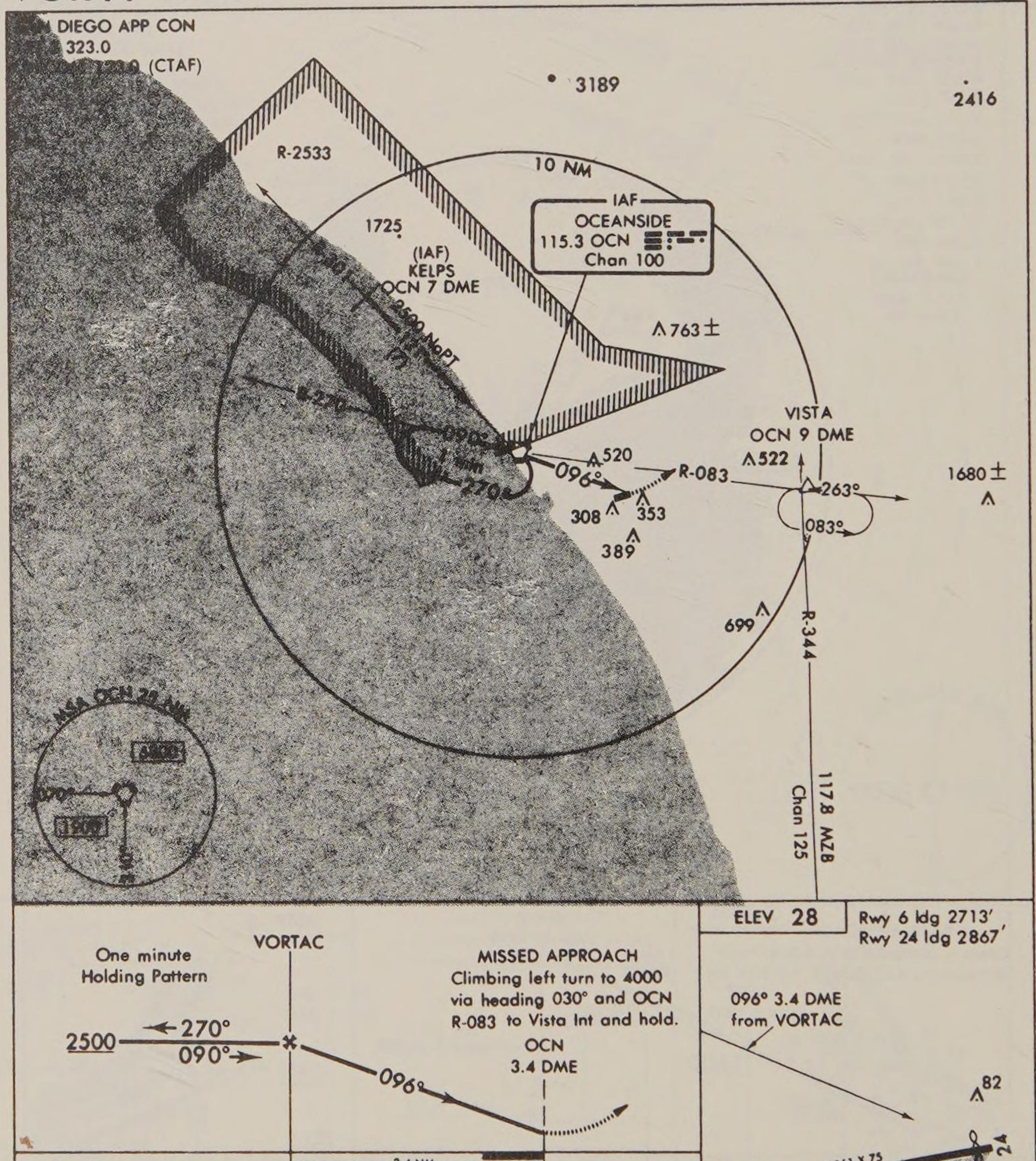
OAKLAND/METROPOLITAN OAKLAND INTL (OAK)

Not for use in Navigation

Amdt 3

VOR-A

OCEANSIDE MUNI (L32)
OCEANSIDE, CALIFORNIA



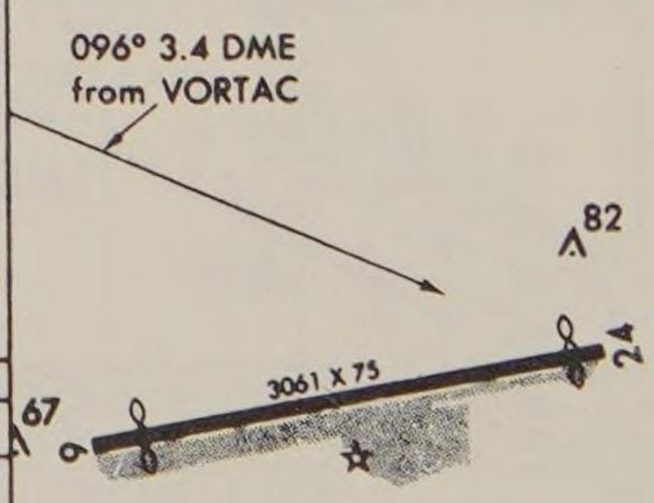
CATEGORY	A	B	C	D
CIRCLING	1140-1¼ 1112 (1200-1¼)	1140-1½ 1112 (1200-1½)	NA	

Use Miramar NAS altimeter setting.
ACTIVATE MIRL Rwy 6-24 on UNICOM.

▼
▲ NA

ELEV 28

Rwy 6 ldg 2713′
Rwy 24 ldg 2867′



MIRL Rwy 6-24
REIL Rwy 24

FAF to MAP 3.4 NM					
Knots	60	90	120	150	180
Min:Sec	3:24	2:16	1:42	1:21	1:08

VOR-A

33°13′N – 117°21′W

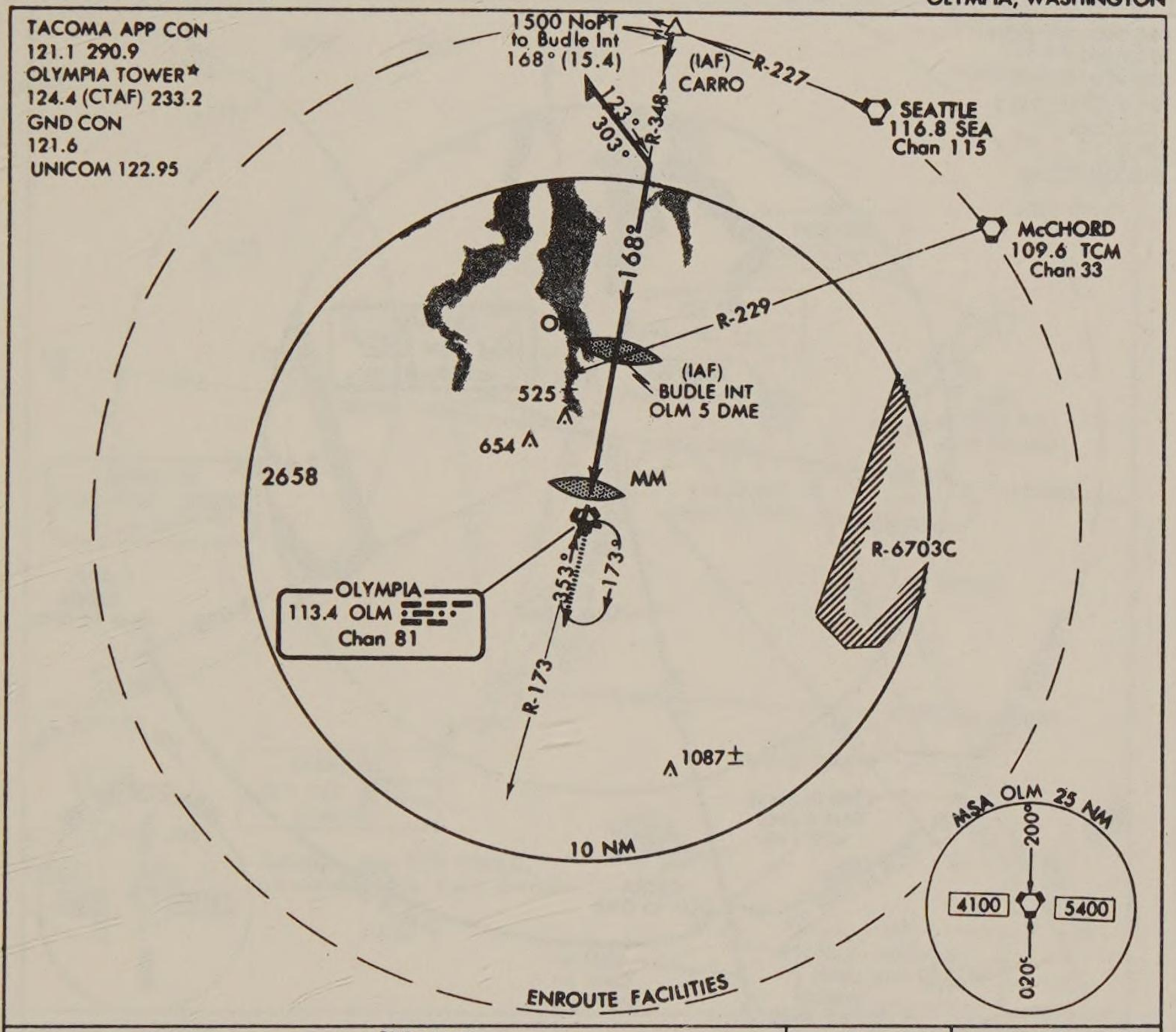
OCEANSIDE, CALIFORNIA
OCEANSIDE MUNI (L32)

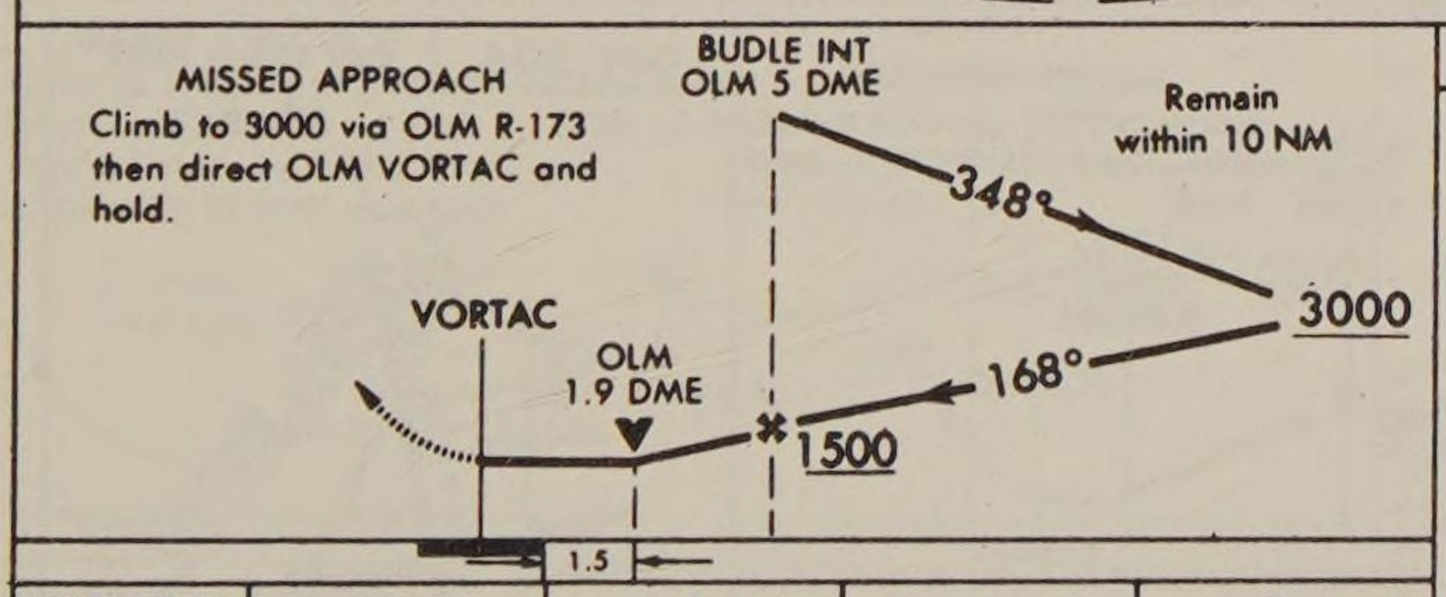
Not for use in Navigation

Amdt 10

VOR RWY 17

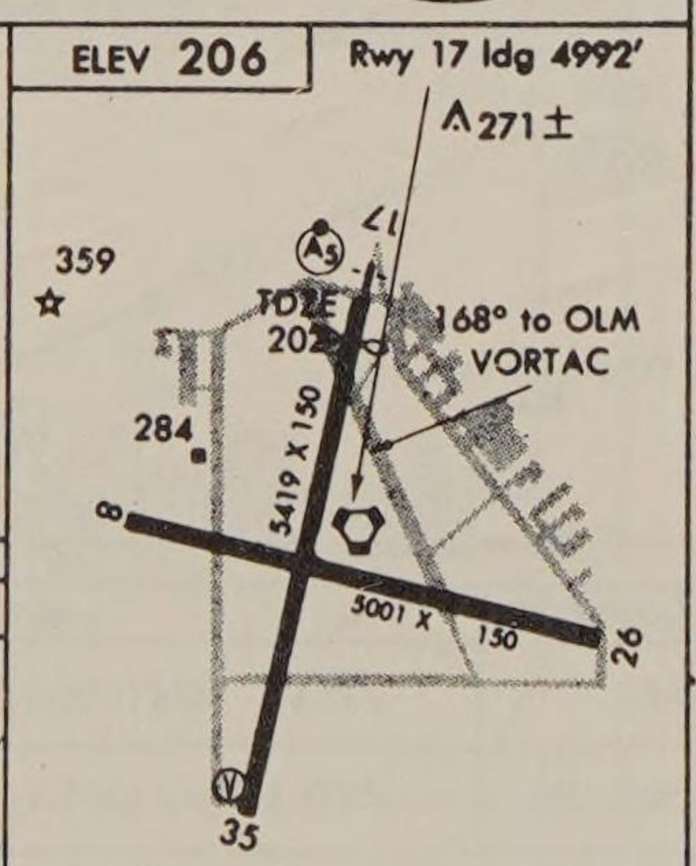
OLYMPIA (OLM)
OLYMPIA, WASHINGTON





CATEGORY	A	B	C	D
S-17	780-¾ 578 (600-¾)		780-1 578 (600-1)	780-1¼ 578 (600-1¼)
CIRCLING	780-1 574 (600-1)		840-1¾ 634 (700-1¾)	960-2½ 754 (800-2½)

ACTIVATE MALSR Rwy 17 and VASI Rwy 35-124.4.
Cat. A and B, straight-in visibility increased ¼ mile for inoperative MALSR.



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 17

46°58'N-122°54'W

OLYMPIA, WASHINGTON
OLYMPIA (OLM)

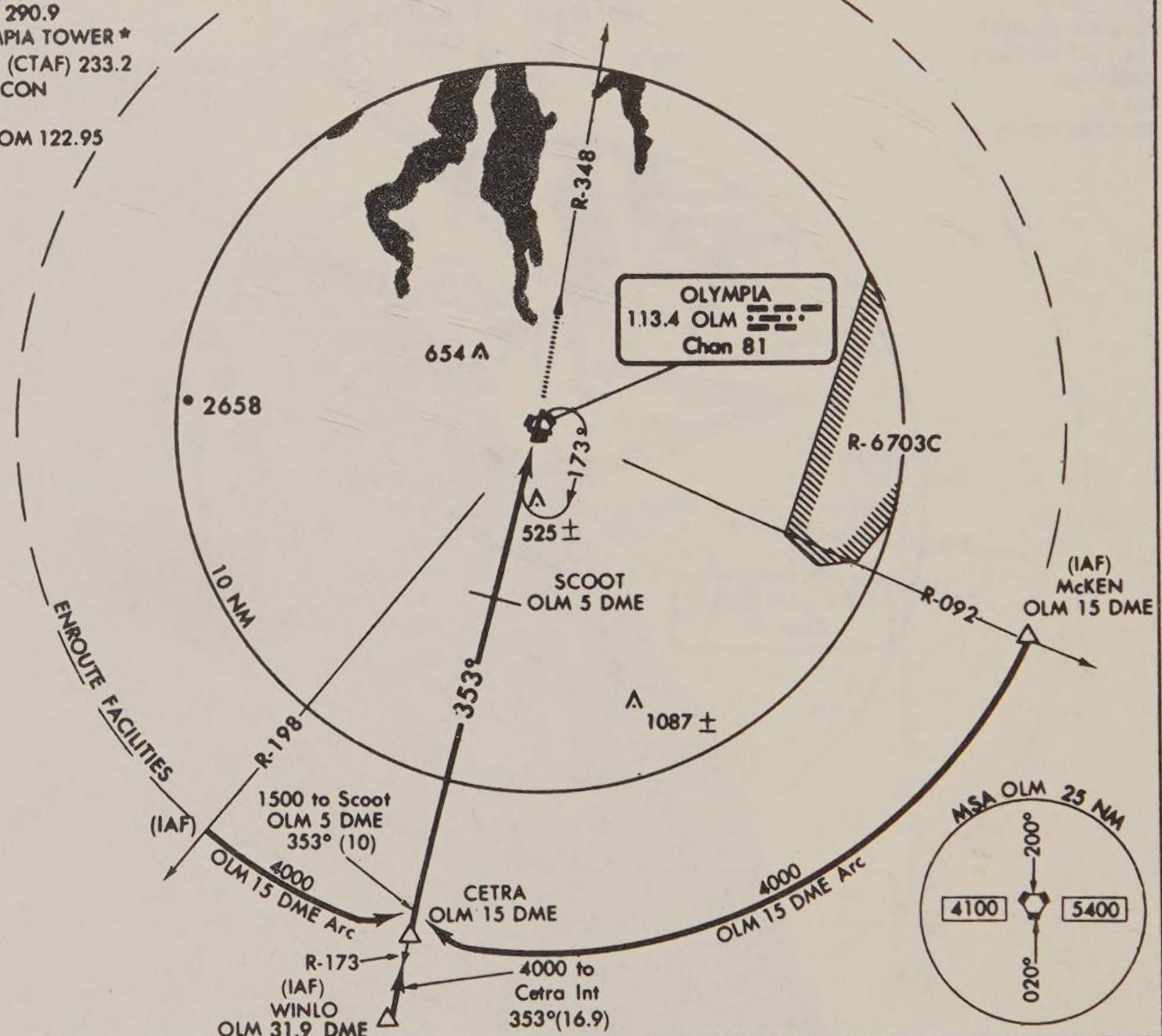
Not for use in Navigation

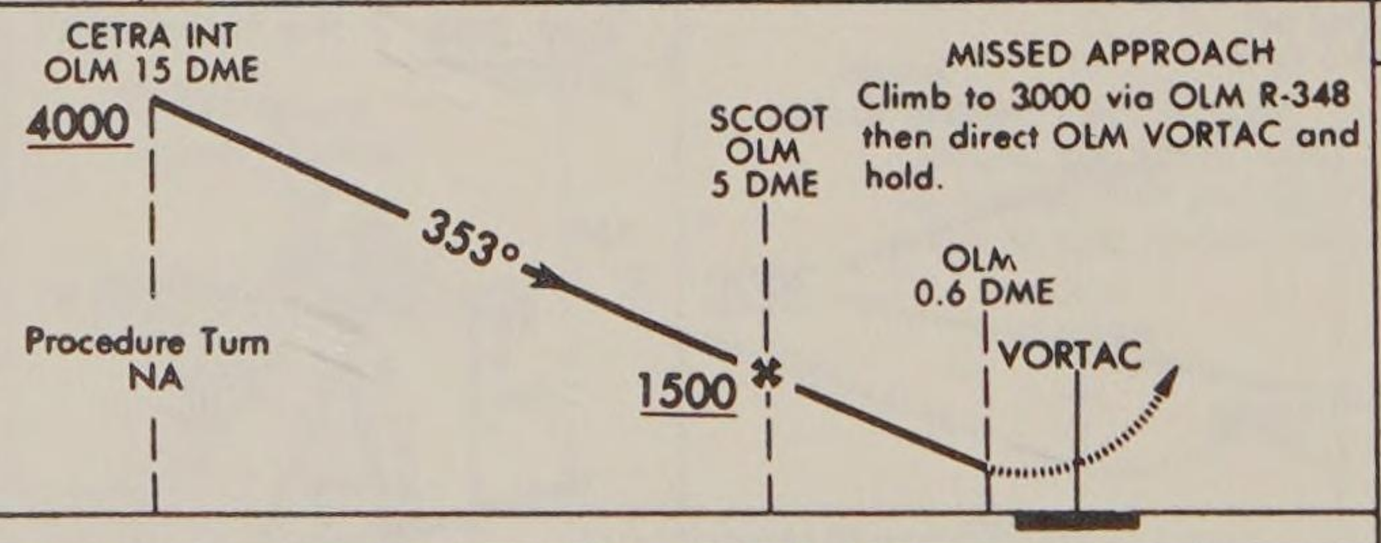
Amdt 10

VOR/DME RWY 35

OLYMPIA (OLM)
OLYMPIA, WASHINGTON

TACOMA APP CON
121.1 290.9
OLYMPIA TOWER ★
124.4 (CTAF) 233.2
GND CON
121.6
UNICOM 122.95



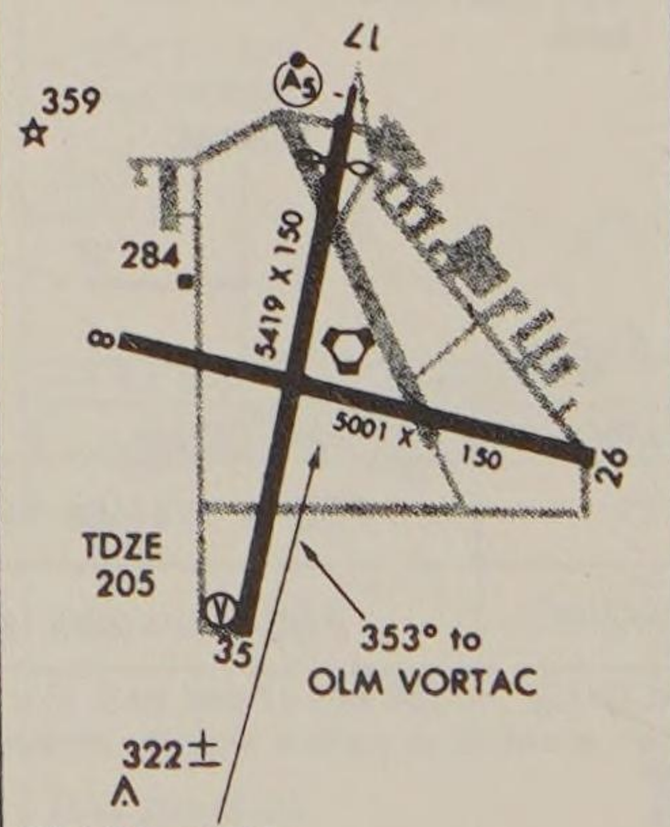


CATEGORY	A	B	C	D
S-35	780-1 575 (600-1)		780-1½ 575 (600-1½)	780-1¾ 575 (600-1¾)
CIRCLING	780-1 574 (600-1)		840-1¾ 634 (700-1¾)	960-2½ 754 (800-2½)

ACTIVATE MALSR Rwy 17 and VASI Rwy 35-124.4.

ELEV 206 | Rwy 17 ldg 4992'

△ 271±



Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 35

46°58'N-122°54'W

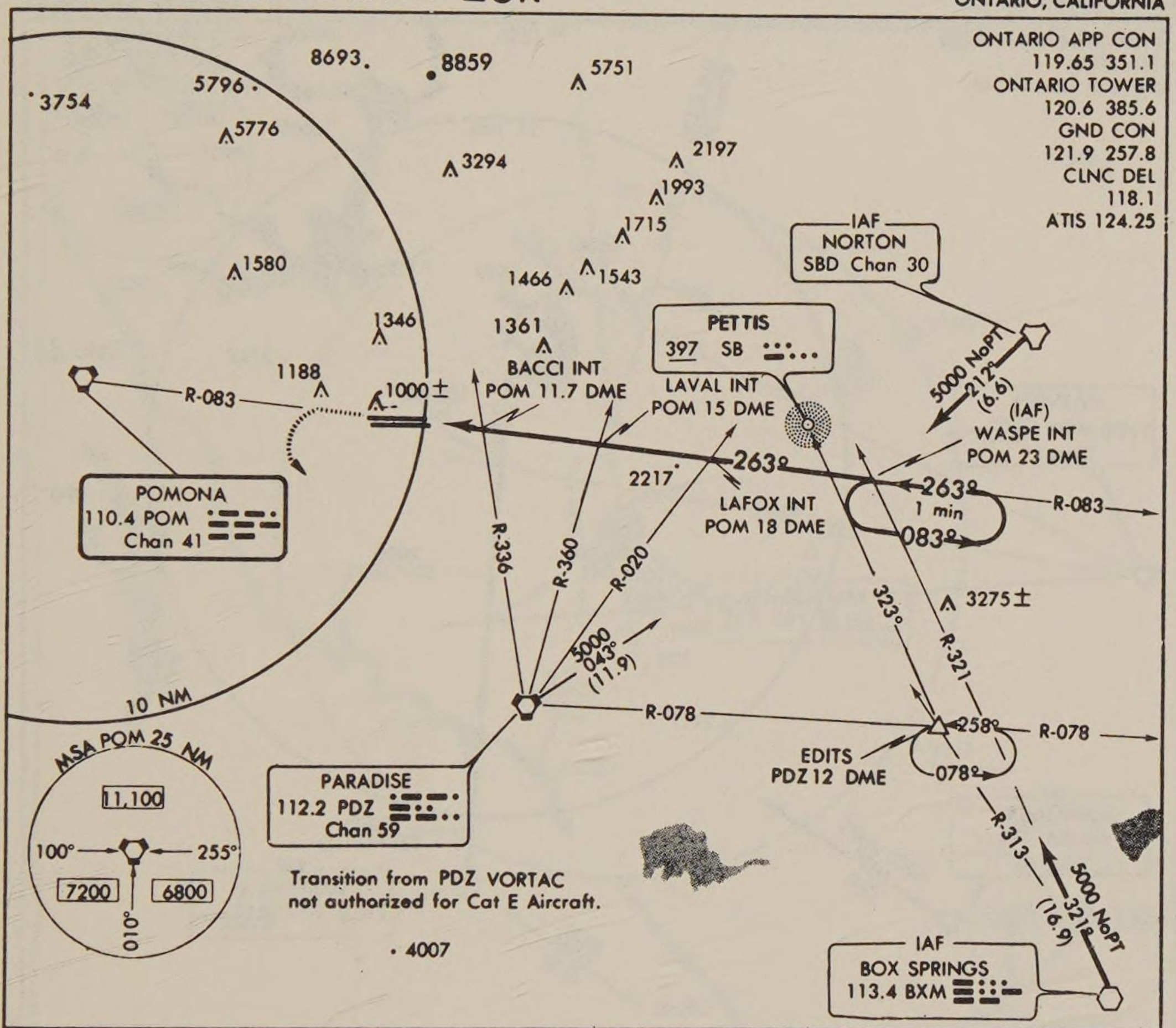
OLYMPIA, WASHINGTON
OLYMPIA (OLM)

Not for use in Navigation

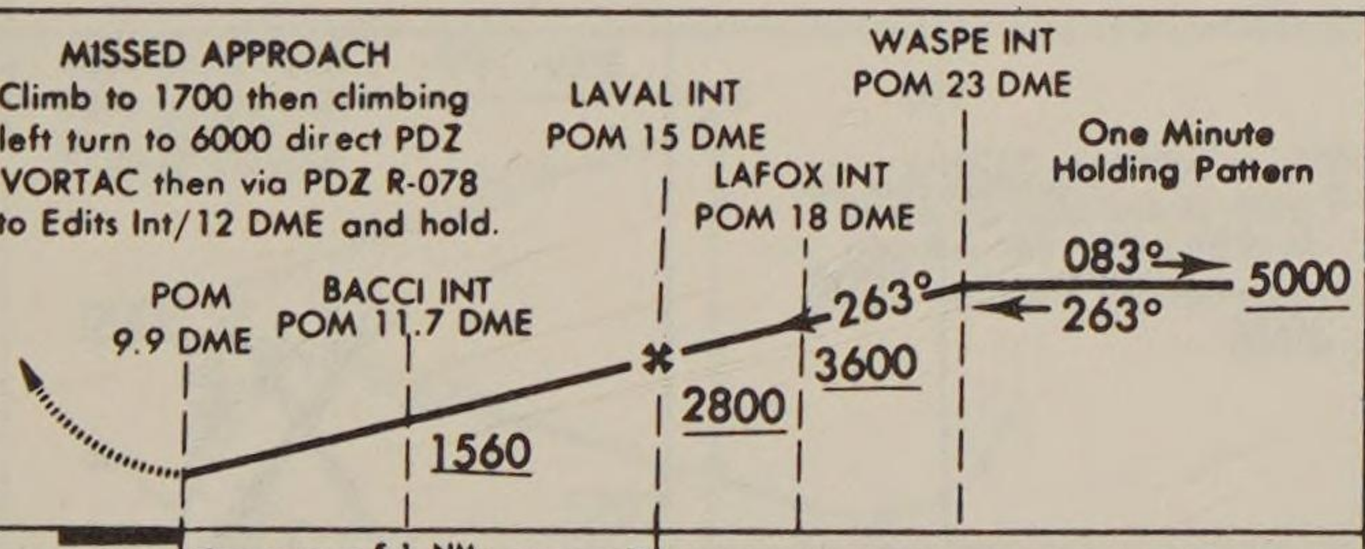
Amdt 8

VOR or TACAN RWY 26R

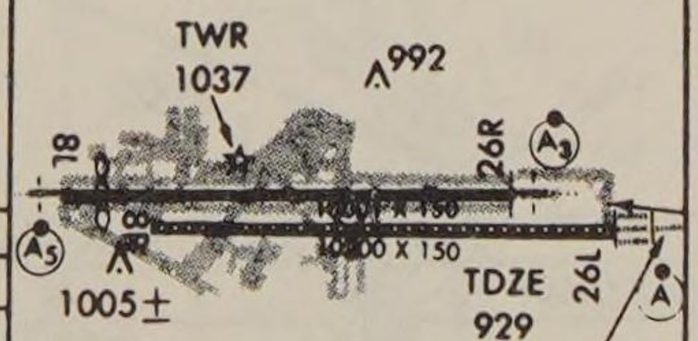
ONTARIO INTERNATIONAL (ONT)
ONTARIO, CALIFORNIA



MISSED APPROACH
Climb to 1700 then climbing left turn to 6000 direct PDZ VORTAC then via PDZ R-078 to Edits Int/12 DME and hold.



ELEV 942 | Rwy 8L ldg 8981'



CATEGORY	A	B	C	D	E
S-26R	1560/24	631 (700-½)	1560/60 631 (700-1¼)	1560-1½ 631 (700-1½)	1560-1¾ 631 (700-1¾)
CIRCLING	1560-1	608 (700-1)	1560-1¾ 608 (700-1¾)	1560-2 608 (700-2)	1680-2½ 728 (800-2½)
DUAL VOR OR DME MINIMA					
S-26R	1420/24	491 (500-½)	1420/40 491 (500-¾)	1420/50 491 (500-1)	1420/60 491 (500-1¼)
CIRCLING	1440-1	488 (500-1)	1440-1½ 488 (500-1½)	1520-2 568 (600-2)	1680-2½ 728 (800-2½)

Circling not authorized northwest of Rwys 8L and 21. ▽▲

TDZ/CL Rwy 26L
HIRL Rwys 8L-26R and 8R-26L

FAF to MAP 5.1 NM

Knots	60	90	120	150	180
Min:Sec	5:06	3:24	2:33	2:02	1:42

VOR or TACAN RWY 26R

34°03'N – 117°36'W

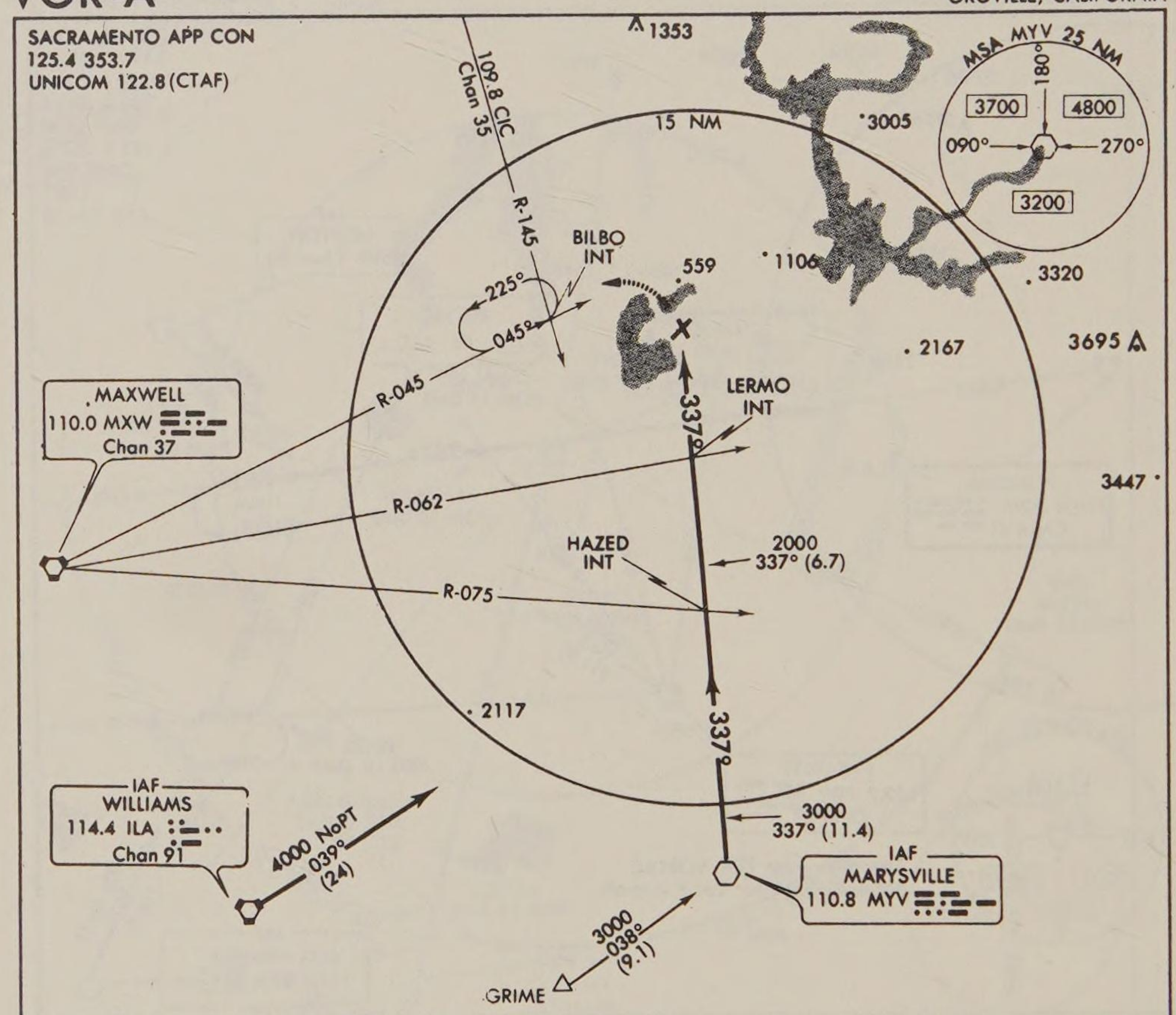
ONTARIO, CALIFORNIA
ONTARIO INTERNATIONAL (ONT)

Not for use in Navigation

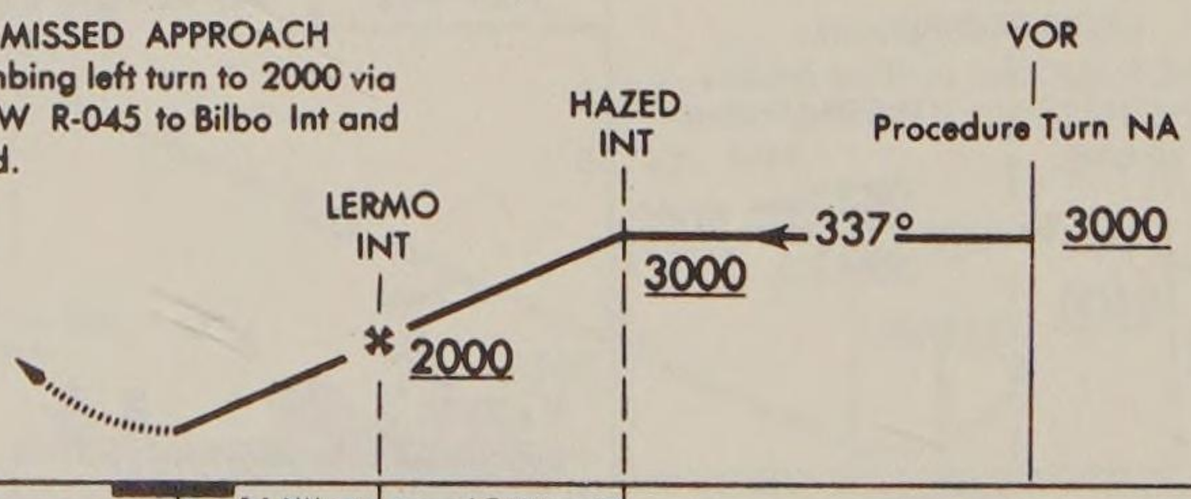
Amdt 3

VOR-A

OROVILLE MUNI (OVE)
OROVILLE, CALIFORNIA



MISSED APPROACH
Climbing left turn to 2000 via MXW R-045 to Bilbo Int and hold.

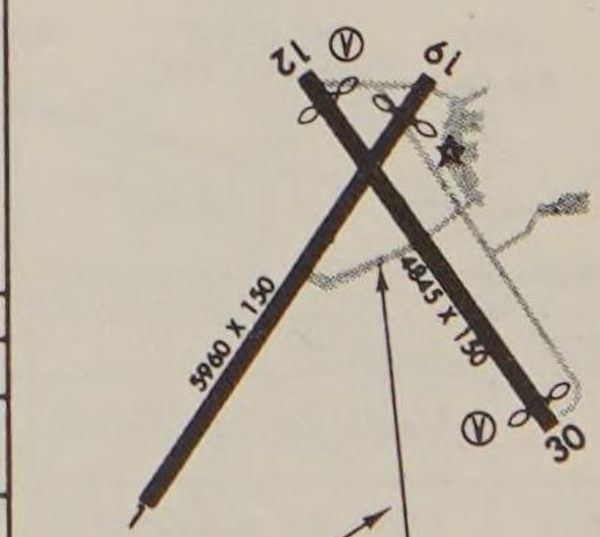


CATEGORY	A	B	C	D
CIRCLING	800-1 601 (700-1)	800-1¼ 601 (700-1¼)	800-1¾ 601 (700-1¾)	NA

Use Beale AFB altimeter setting.
T
A NA

ELEV 199

Rwy 12 ldg 4385′
Rwy 30 ldg 4625′
Rwy 19 ldg 5404′



FAF to MAP 5.1 NM					
Knots	60	90	120	150	180
Min:Sec	5:06	3:24	2:33	2:02	1:42

VOR-A

39°29′N – 121°37′W

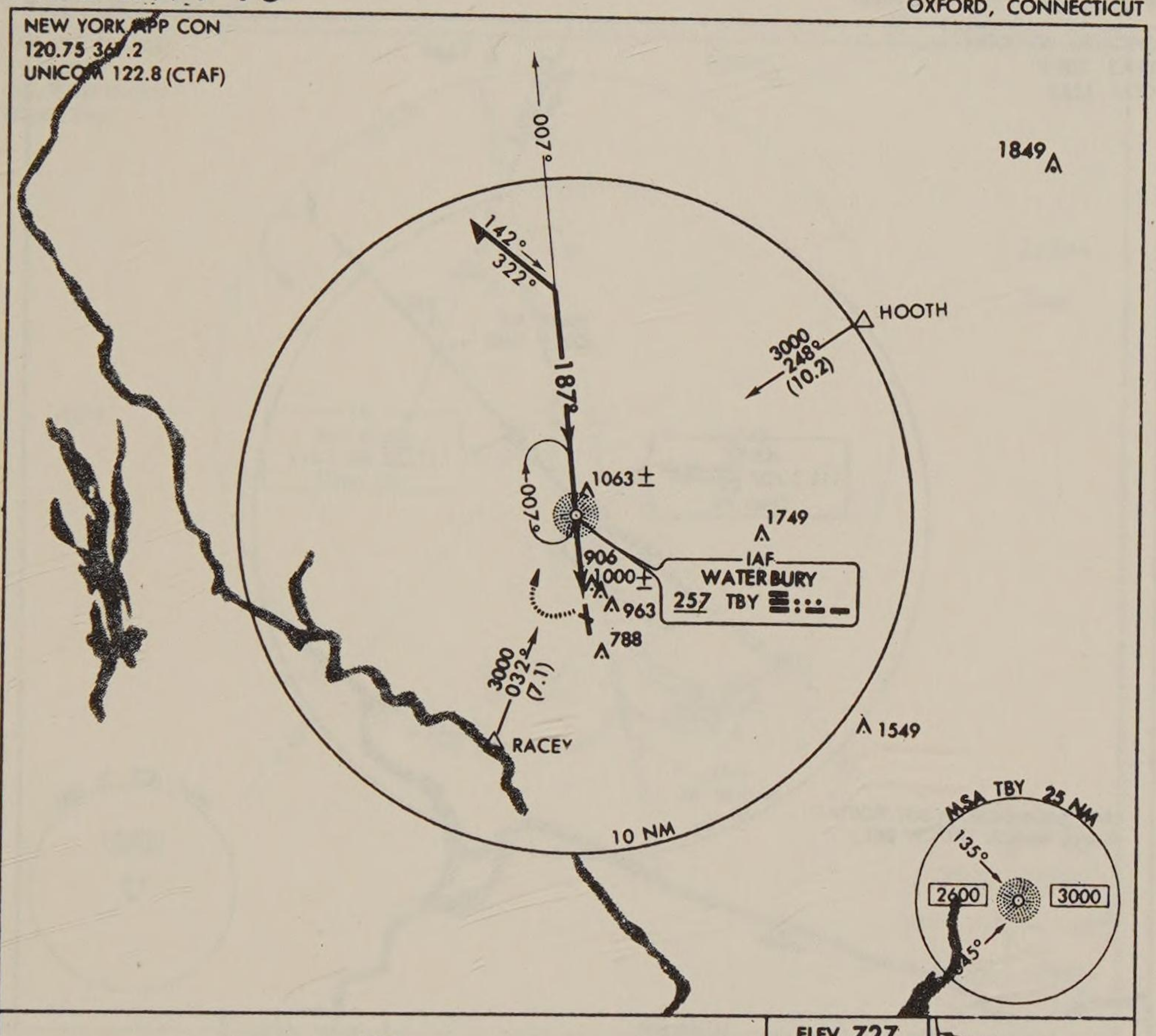
OROVILLE, CALIFORNIA
OROVILLE MUNI (OVE)

Not for use in Navigation

Amdt 2

NDB RWY 18

OXFORD/WATERBURY-OXFORD (OXC)
OXFORD, CONNECTICUT



CATEGORY	A	B	C	D
S-18	1300-1 573 (600-1)		1300-1½ 573 (600-1½)	1300-1¾ 573 (600-1¾)
CIRCLING	1300-1 573 (600-1)		1300-1½ 573 (600-1½)	1320-2 593 (600-2)

Obtain local altimeter setting on UNICOM 122.8; when not available, use White Plains altimeter setting and increase all MDA s 160 feet.
ACTIVATE MIRL Rwy 18-36-122.8.
T
A NA

FAF to MAP 2.6 NM					
Knots	60	90	120	150	180
Min:Sec	2:36	1:44	1:18	1:02	0:52

NDB RWY 18

41°29'N – 73°08'W

OXFORD, CONNECTICUT
OXFORD/WATERBURY-OXFORD (OXC)

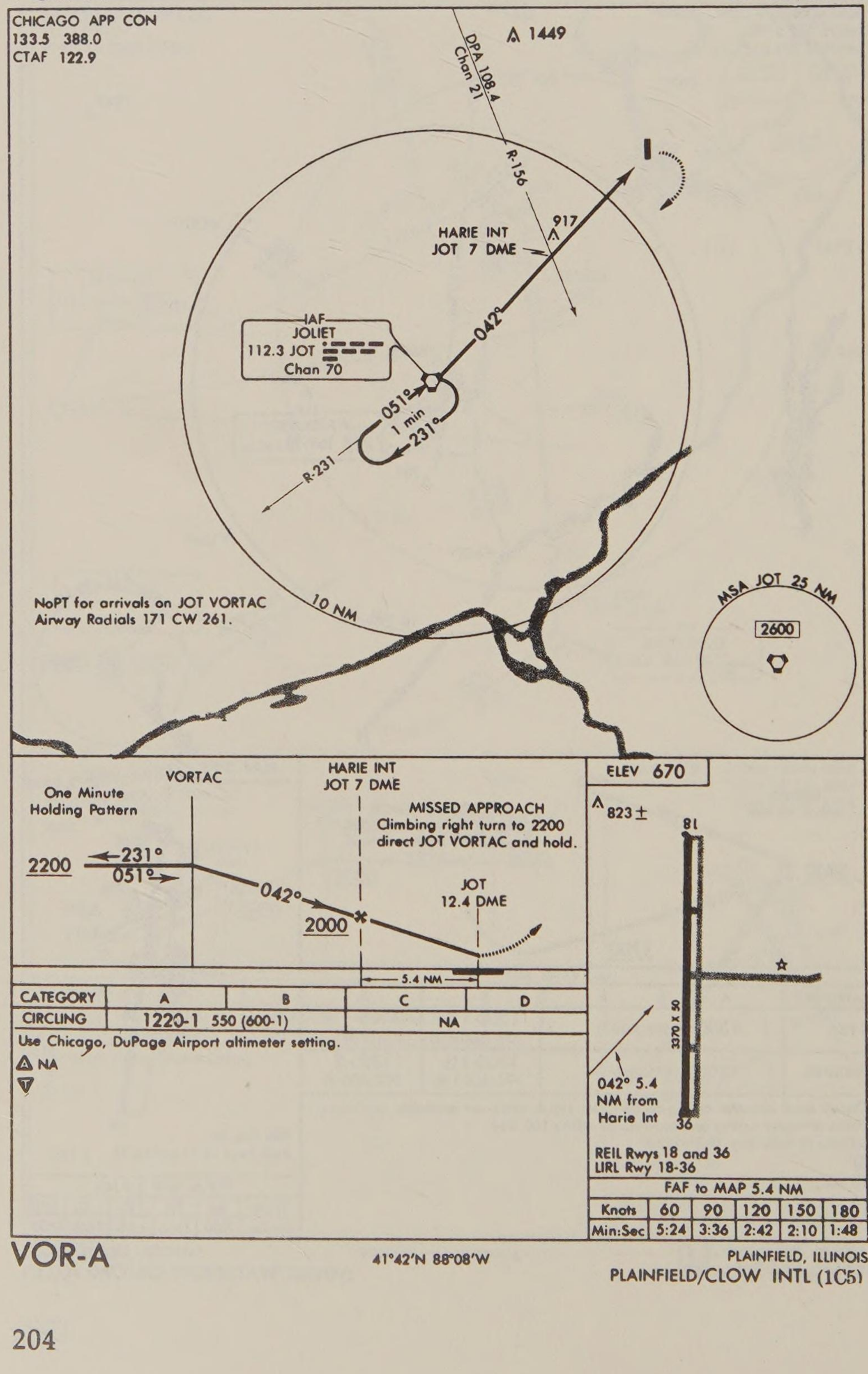
Not for use in Navigation

Amdt 1

VOR-A

PLAINFIELD/CLOW INTL (1C5)

PLAINFIELD, ILLINOIS



CATEGORY	A	B	C	D
CIRCLING	1220-1 550 (600-1)		NA	

Use Chicago, DuPage Airport altimeter setting.

A NA

T

FAF to MAP 5.4 NM					
Knots	60	90	120	150	180
Min:Sec	5:24	3:36	2:42	2:10	1:48

VOR-A

41°42'N 88°08'W

PLAINFIELD, ILLINOIS

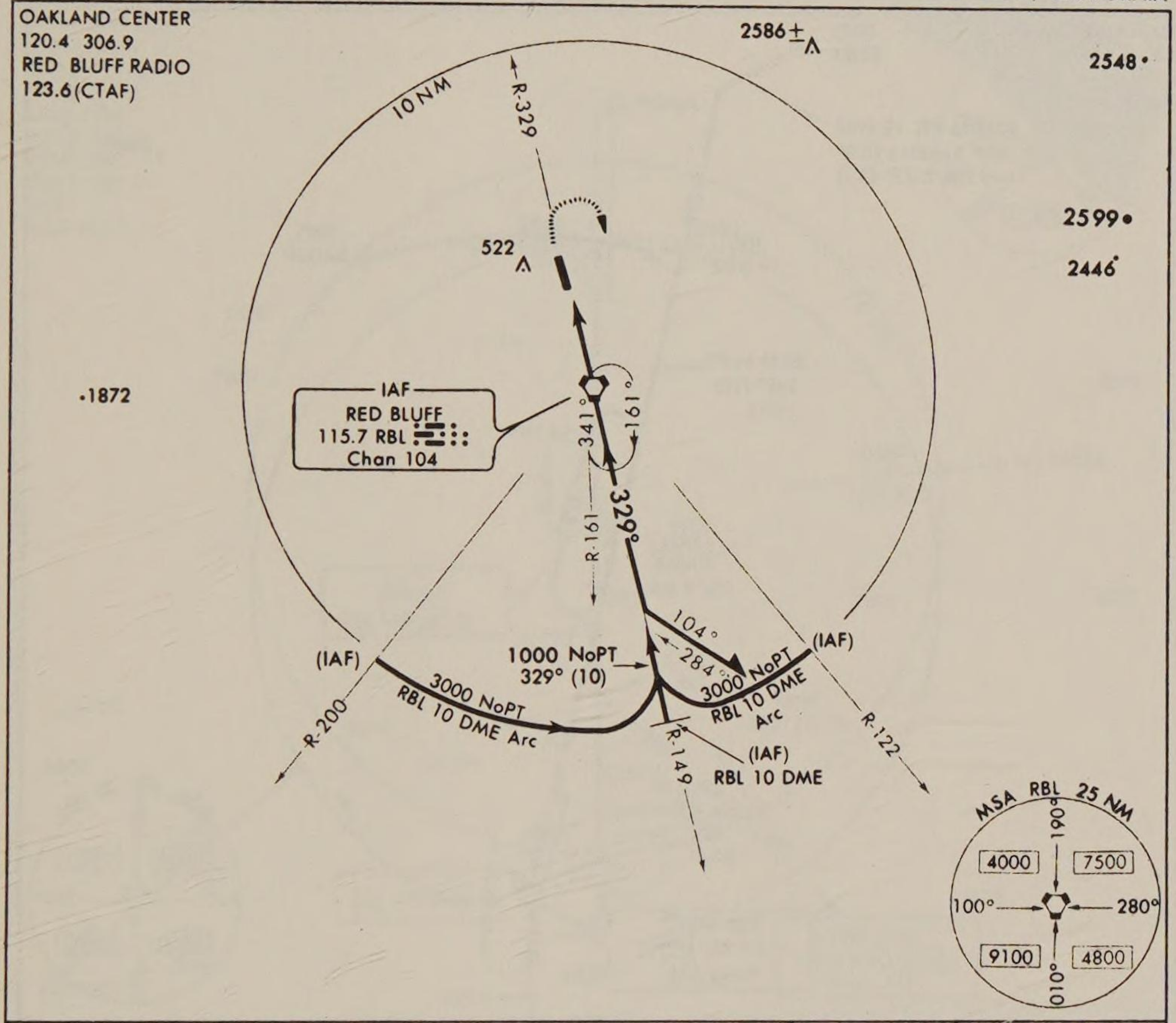
PLAINFIELD/CLOW INTL (1C5)

Not for use in Navigation

Amdt 2

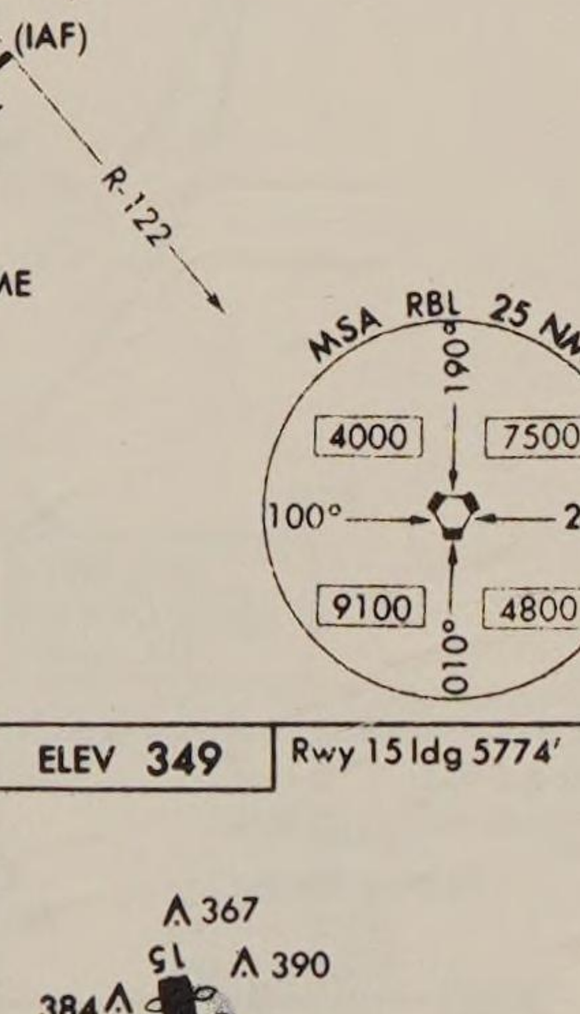
VOR RWY 33

RED BLUFF MUNI (RBL)
RED BLUFF, CALIFORNIA



CATEGORY	A	B	C	D
S-33	740-1 391 (400-1)			740-1¼ 391 (400-1¼)
CIRCLING	840-1 491 (500-1)		840-1½ 491 (500-1½)	900-2 551 (600-2)

ELEV 349 | Rwy 15 ldg 5774'



FAF to MAP 2.7 NM

Knots	60	90	120	150	180
Min:Sec	2:42	1:48	1:21	1:05	0:54

VOR RWY 33

40°09'N-122°15'W

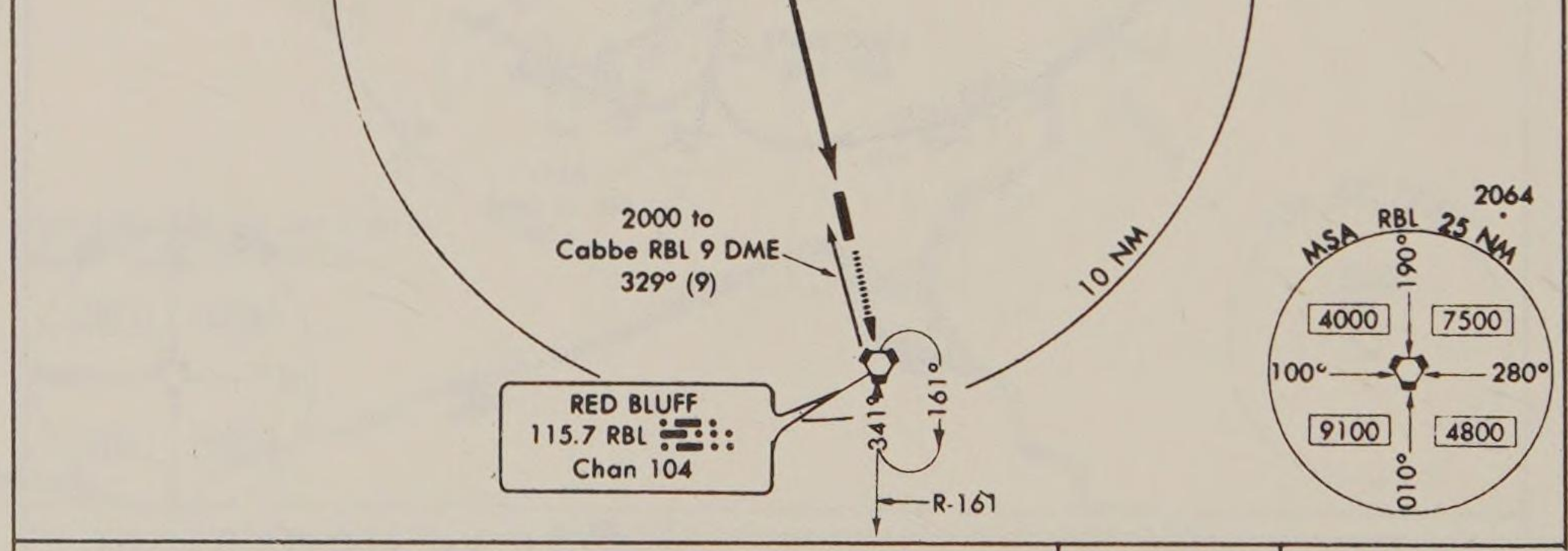
RED BLUFF, CALIFORNIA
RED BLUFF MUNI (RBL)

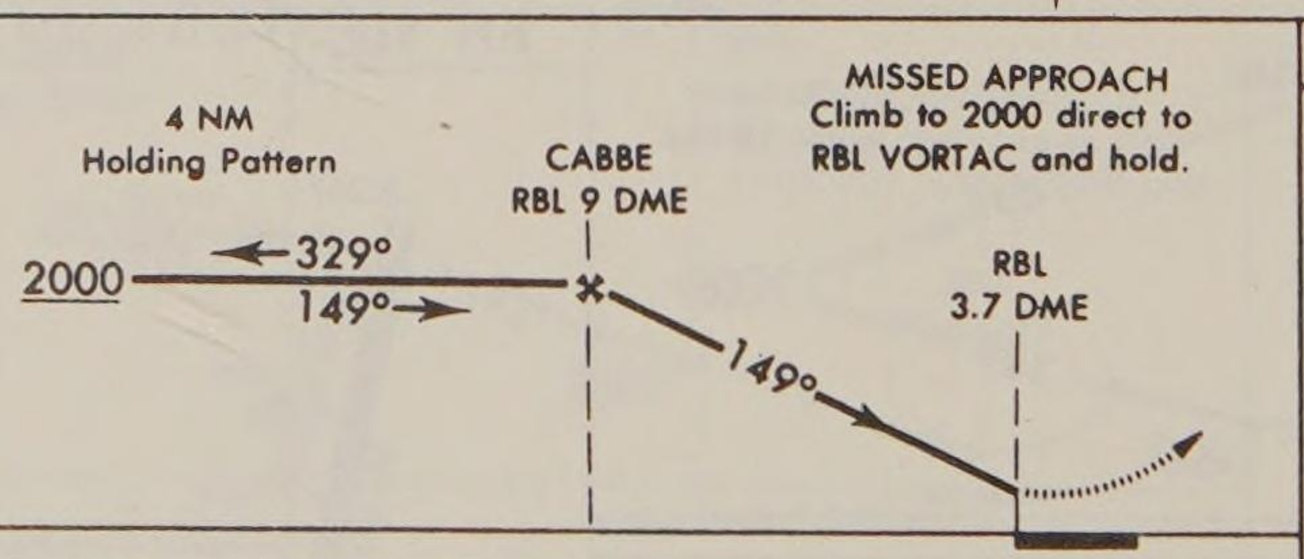
Not for use in Navigation

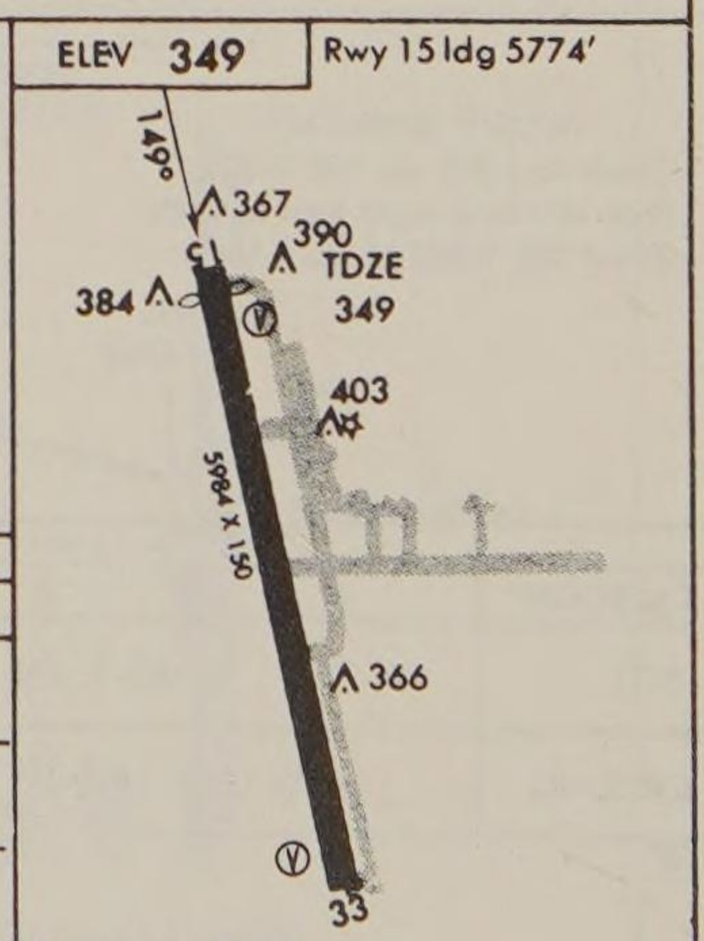
Amdt 1

VOR/DME RWY 15

RED BLUFF MUNI (RBL)
RED BLUFF, CALIFORNIA







CATEGORY	A	B	C	D
S-15	820-1 471 (500-1)		820-1¼ 471 (500-1¼)	820-1½ 471 (500-1½)
CIRCLING	840-1 491 (500-1)		840-1½ 491 (500-1½)	900-2 551 (600-2)

Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 15

40°09'N – 122°15'W

RED BLUFF, CALIFORNIA
RED BLUFF MUNI (RBL)

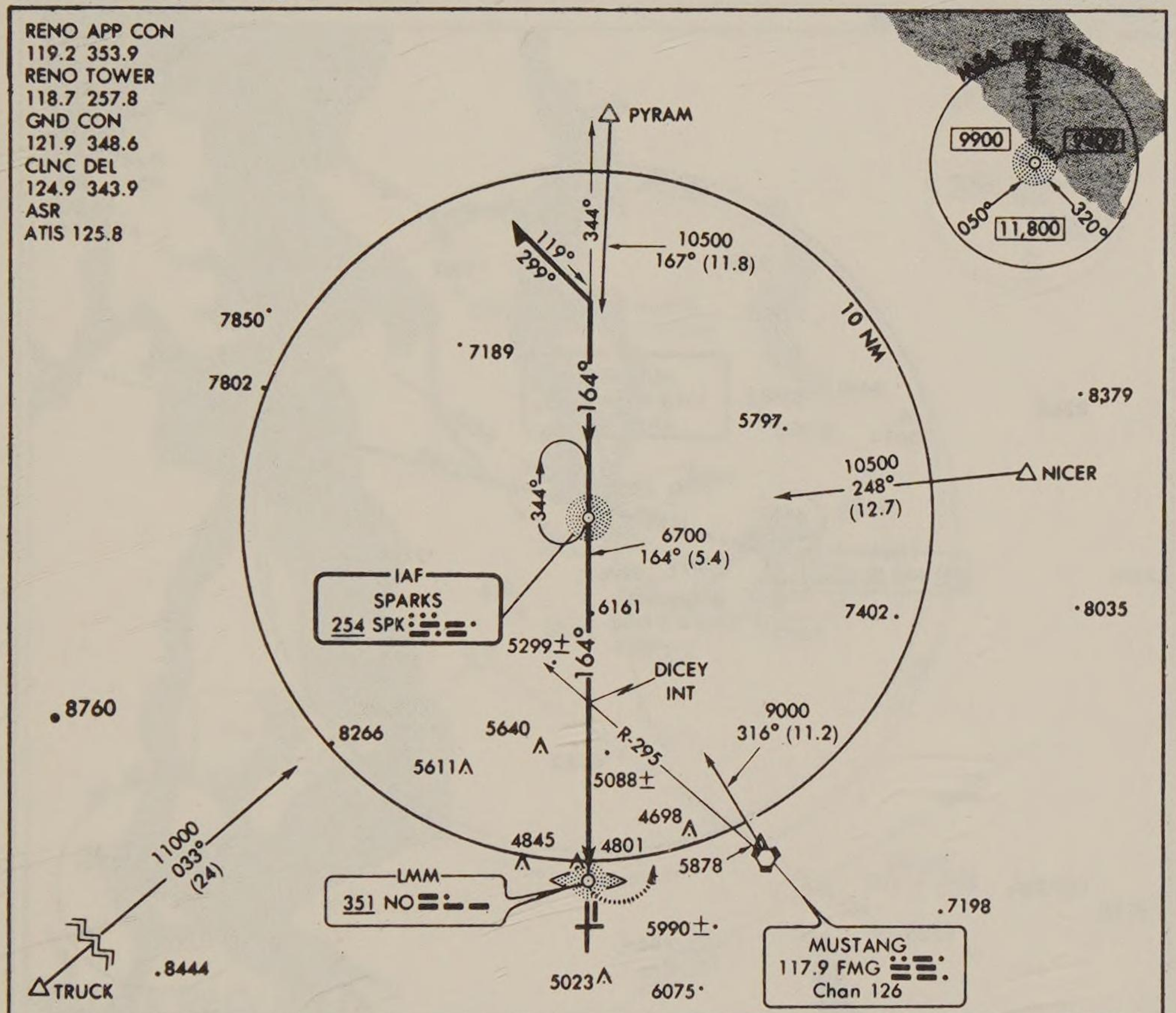
Not for use in Navigation

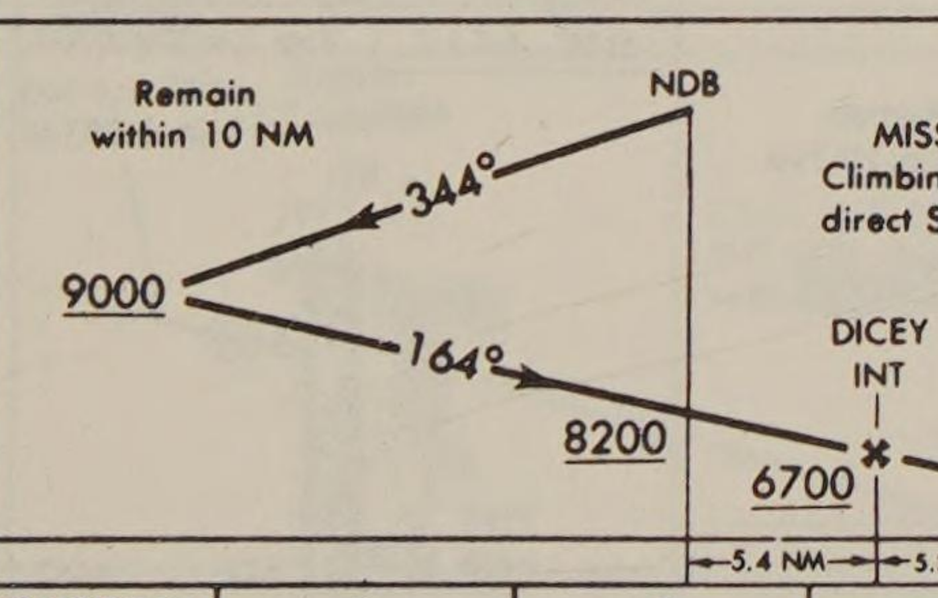
Amdt 3

NDB RWY 16R

RENO CANNON INTERNATIONAL (RNO)
RENO, NEVADA

RENO APP CON
119.2 353.9
RENO TOWER
118.7 257.8
GND CON
121.9 348.6
CLNC DEL
124.9 343.9
ASR
ATIS 125.8



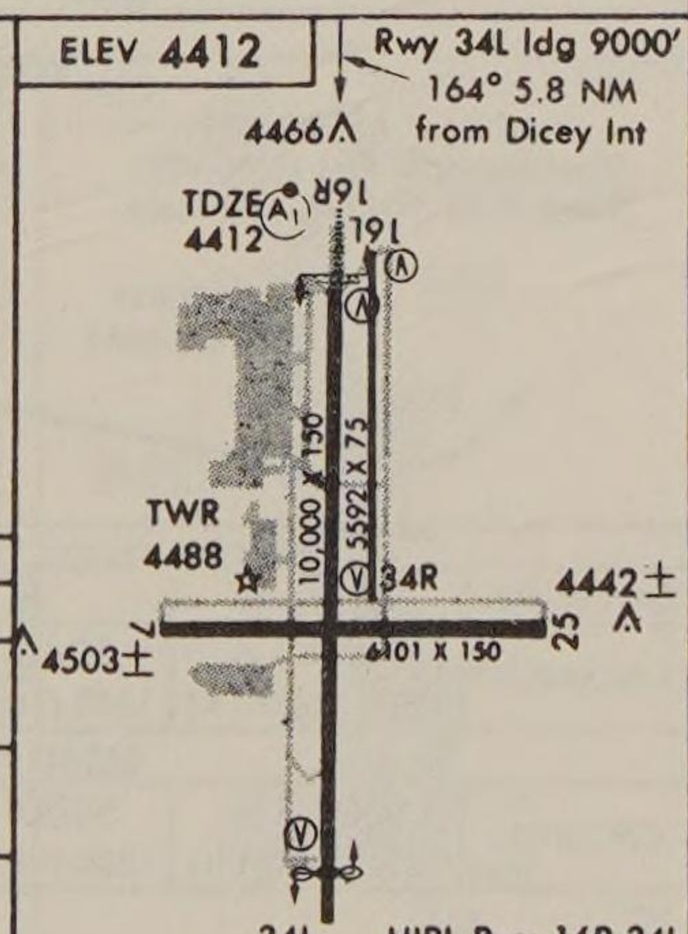


CATEGORY	A	B	C	D
S-16R	6060-1¼ 1648 (1700-1¼)	6060-1½ 1648 (1700-1½)	6060-3 1648 (1700-3)	
CIRCLING	6060-1¼ 1648 (1700-1¼)	6060-1½ 1648 (1700-1½)	6060-3 1648 (1700-3)	

Inoperative table does not apply.

ELEV 4412

Rwy 34L Idg 9000'
164° 5.8 NM
from Dicey Int



FAF to MAP 5.3 NM					
Knots	60	90	120	150	180
Min:Sec	5:18	3:32	2:39	2:07	1:46

NDB RWY 16R

39°30'N-119°46'W

RENO, NEVADA
RENO CANNON INTERNATIONAL (RNO)

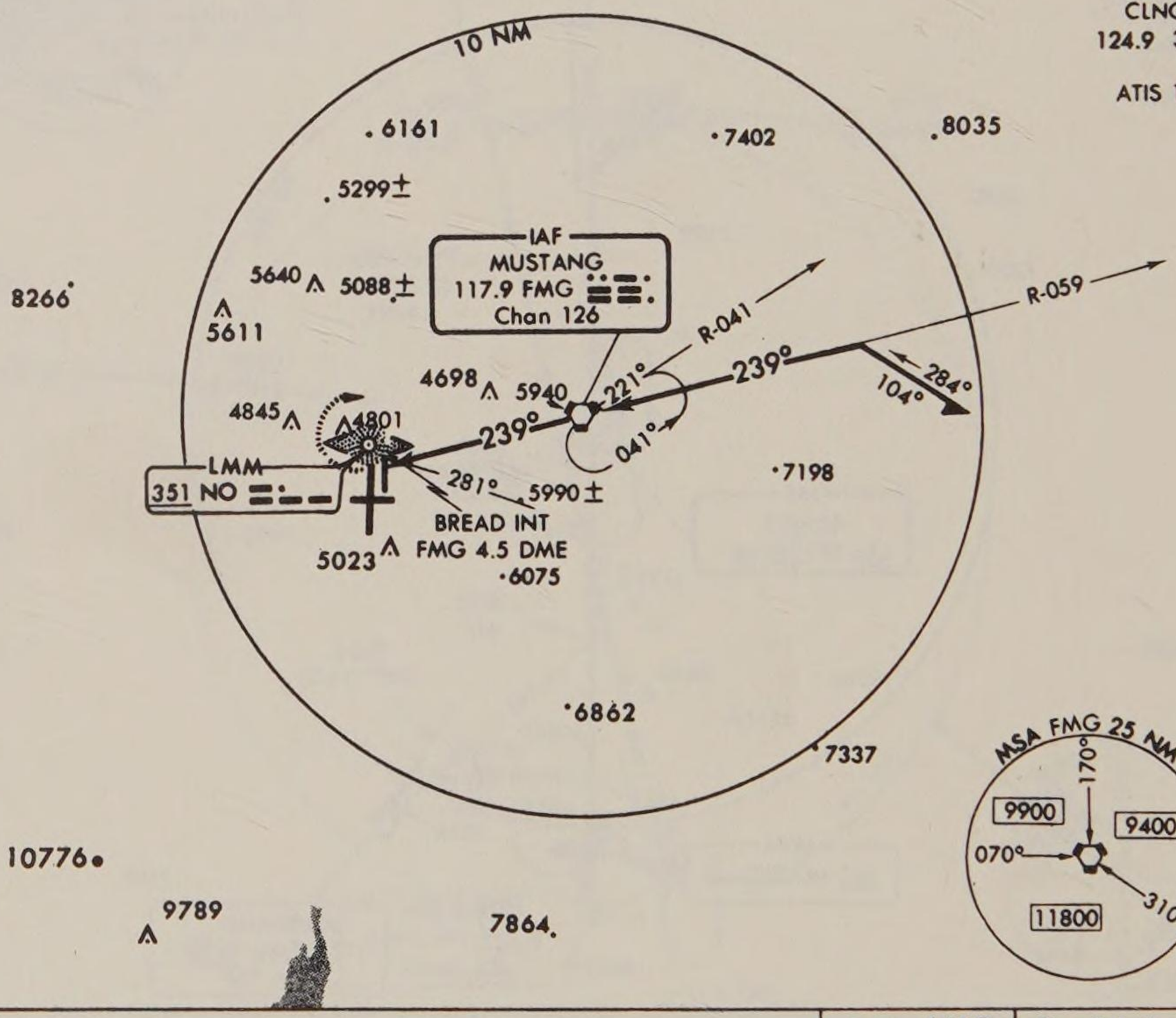
Not for use in Navigation

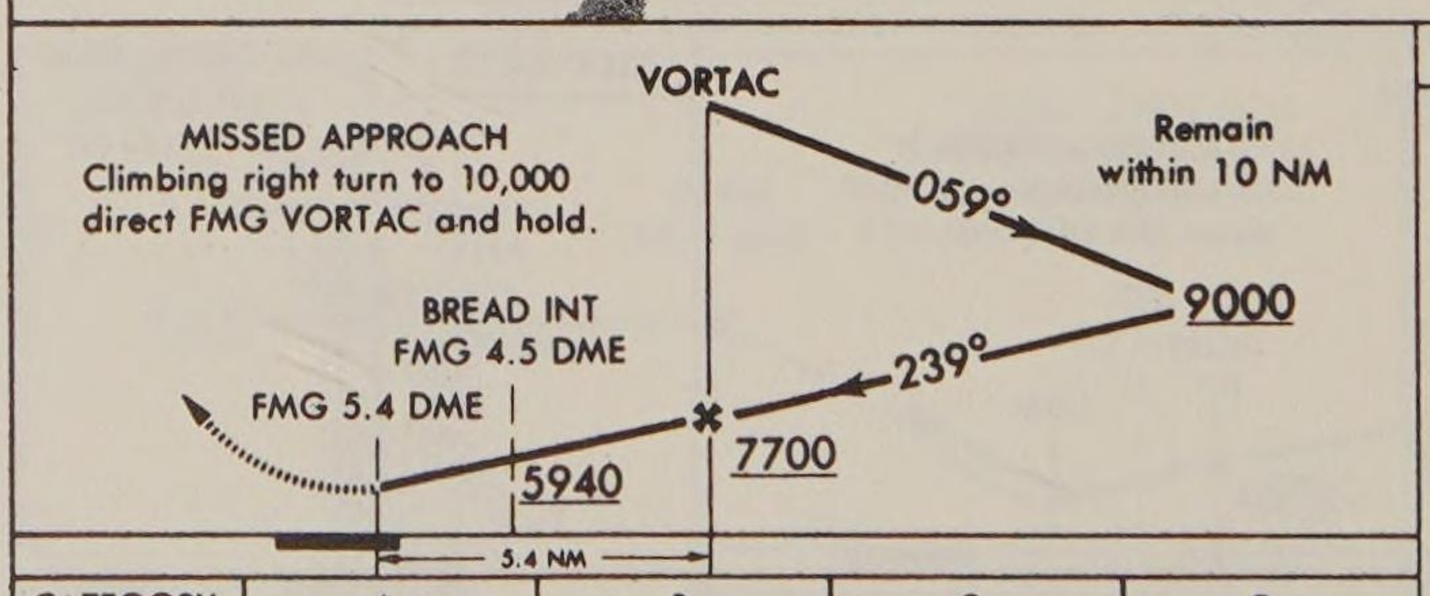
Amdt 5

VOR-D

RENO CANNON INTERNATIONAL (RNO)
RENO, NEVADA

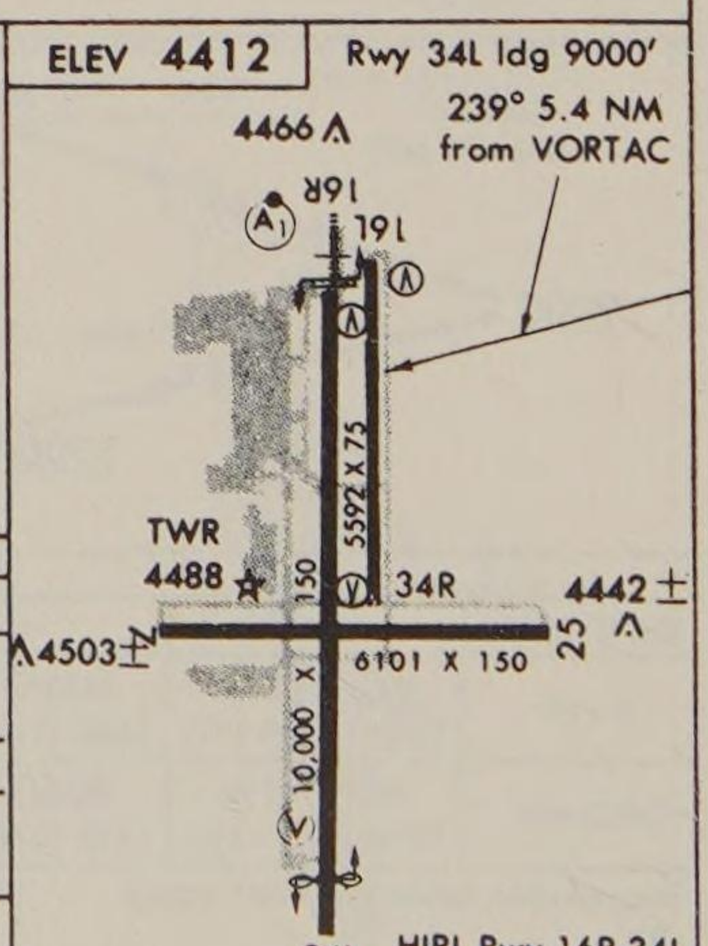
RENO APP CON
119.2 353.9
RENO TOWER
118.7 257.8
GND CON
121.9 348.6
CLNC DEL
124.9 343.9
ASR
ATIS 125.8





CATEGORY	A	B	C	D
CIRCLING	5940-1¼ 1528 (1600-1¼)	5940-1½ 1528 (1600-1½)	5940-3 1528 (1600-3)	
BREAD FIX MINIMUMS				
CIRCLING	5800-1¼ 1388 (1400-1¼)	5800-1½ 1388 (1400-1½)	5800-3 1388 (1400-3)	

ELEV 4412 — Rwy 34L ldg 9000'



HIRL Rwy 16R-34L
REIL Rwys 7 and 25
MIRL Rwys 7-25 and 16L-34R

FAF to MAP 5.4 NM

Knots	60	90	120	150	180
Min:Sec	5:24	3:36	2:42	2:10	1:48

VOR-D

39°30'N – 119°46'W

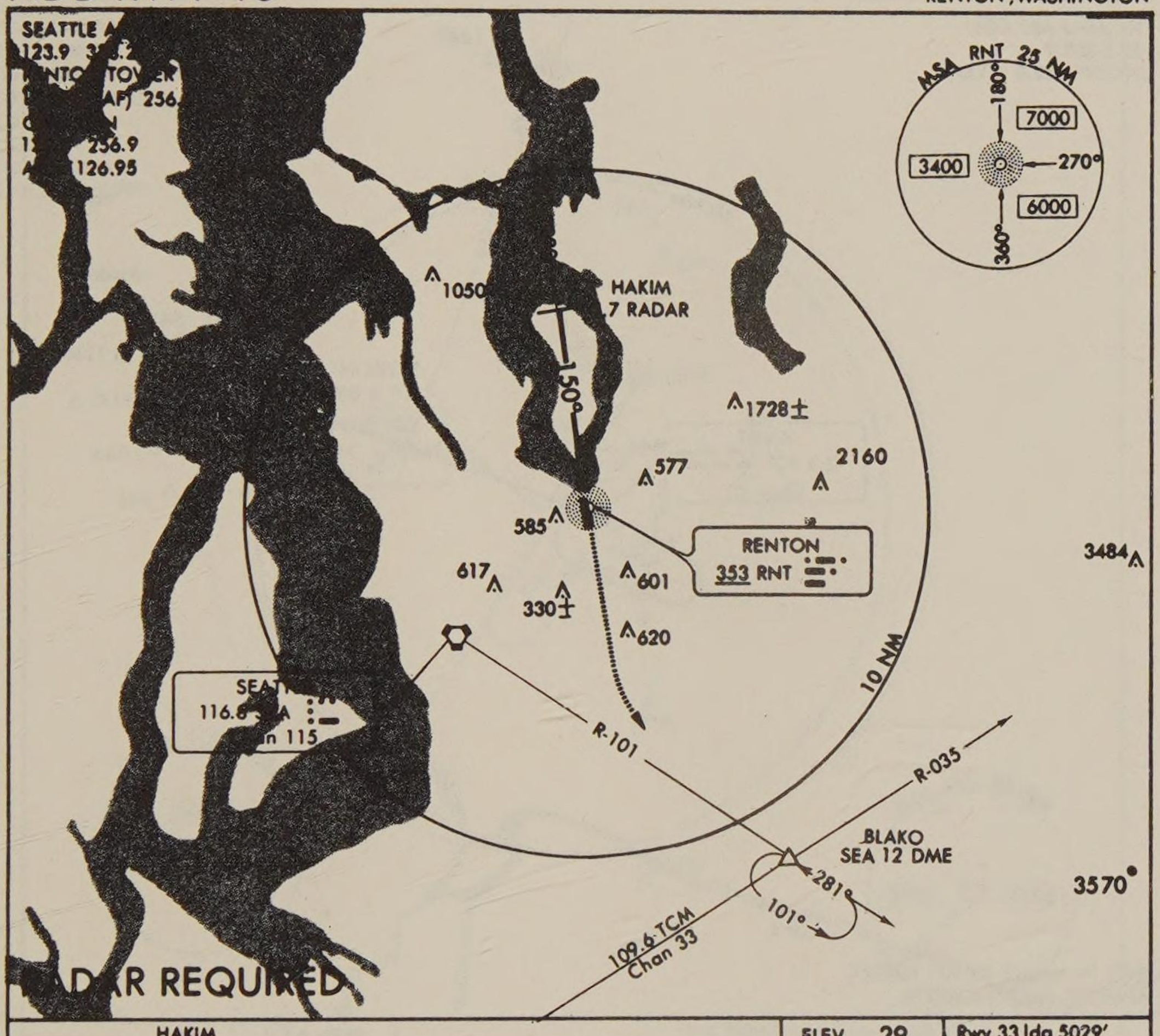
RENO, NEVADA
RENO CANNON INTERNATIONAL (RNO)

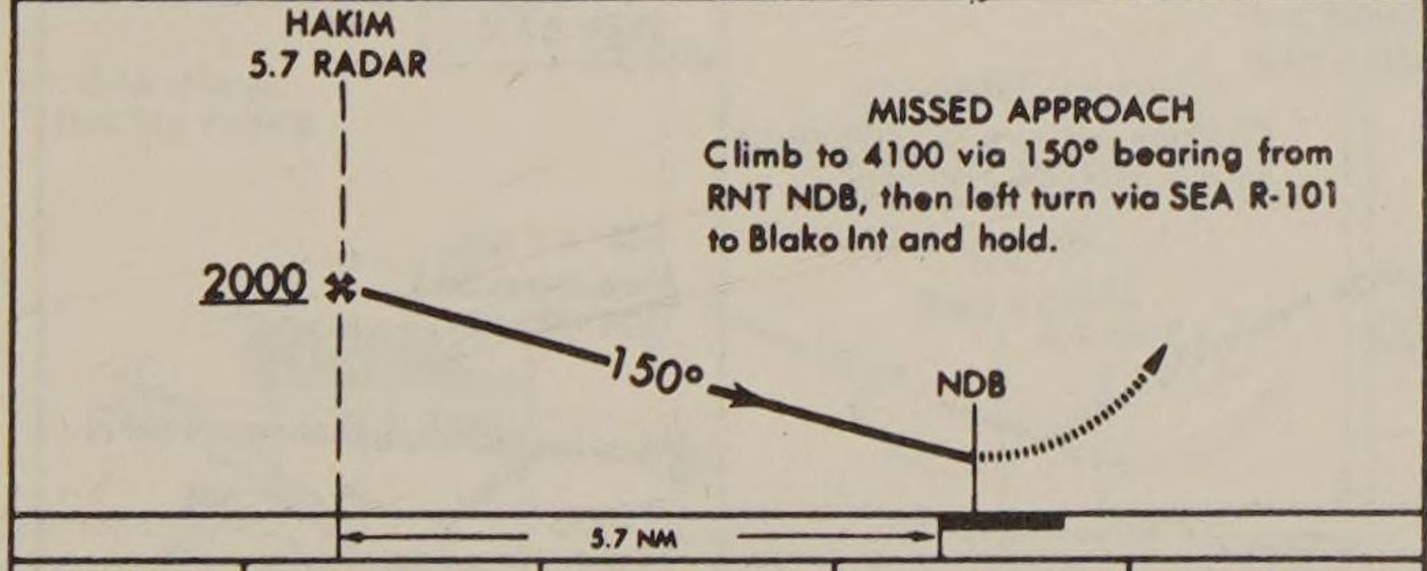
Not for use in Navigation

Orig

NDB RWY 15

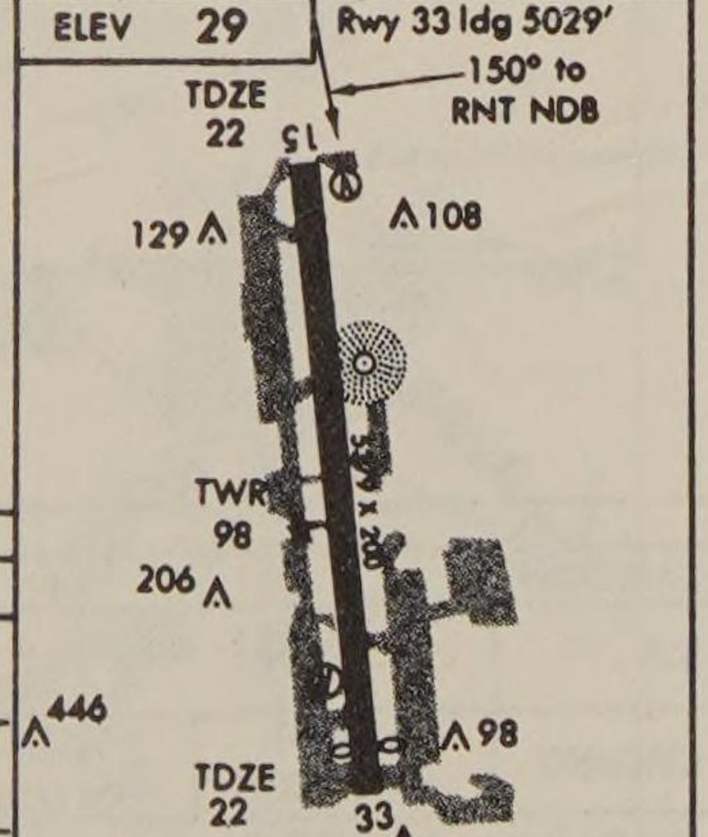
RENTON MUNI (RNT)
RENTON, WASHINGTON





CATEGORY	A	B	C	D
S-15	860-1 838 (900-1)	860-1¼ 838 (900-1¼)	860-2½ 838 (900-2½)	860-2¾ 838 (900-2¾)
CIRCLING	880-1 851 (900-1)	880-1¼ 851 (900-1¼)	920-2¾ 891 (900-2¾)	920-3 891 (900-3)

When Renton Tower not in operation the following applies: 1. Use Seattle altimeter setting. 2. Alternate minimums not authorized.



Knots	60	90	120	150	180
Min:Sec					

NDB RWY 15

47°30'N-122°13'W

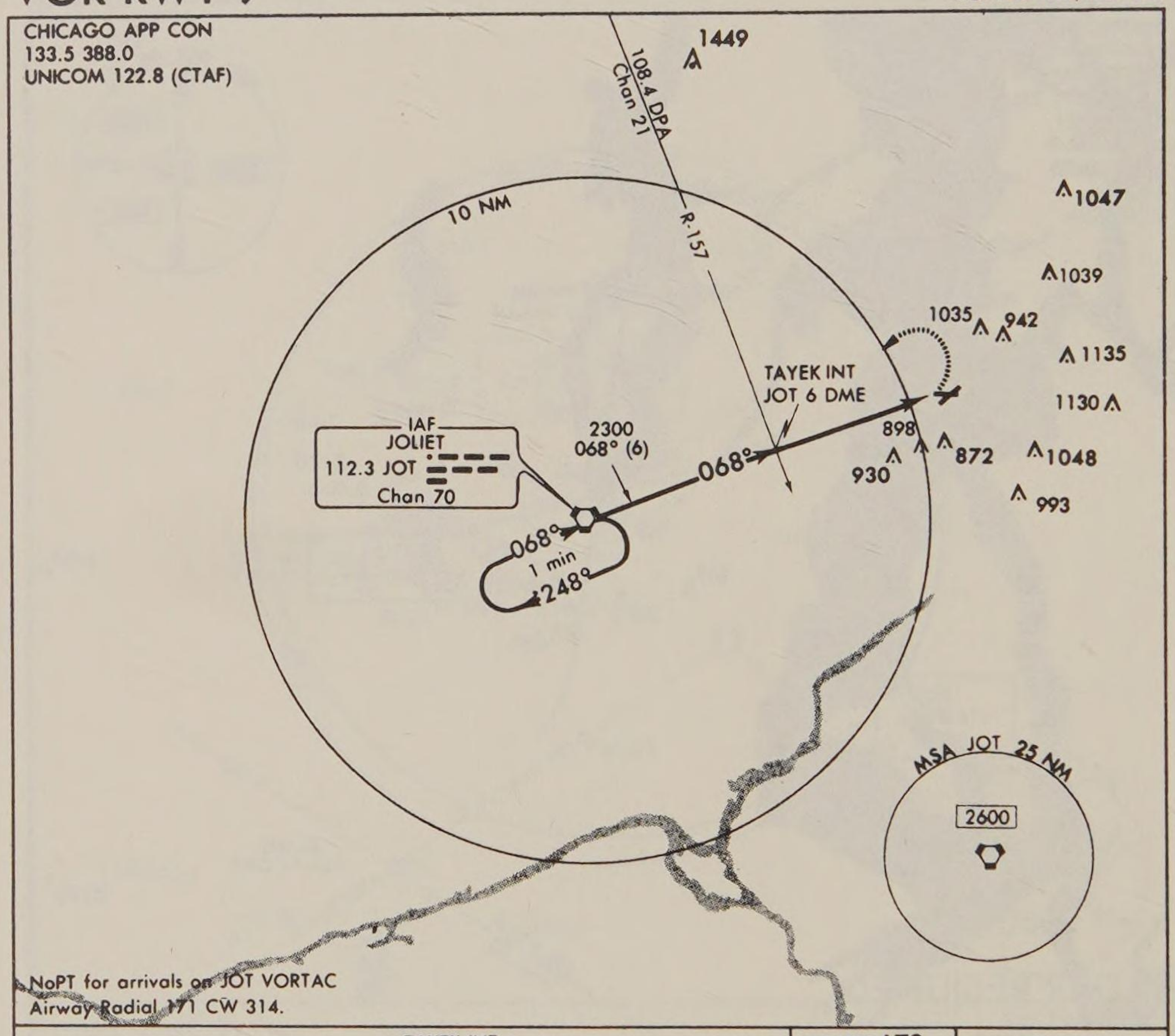
RENTON, WASHINGTON
RENTON MUNI (RNT)

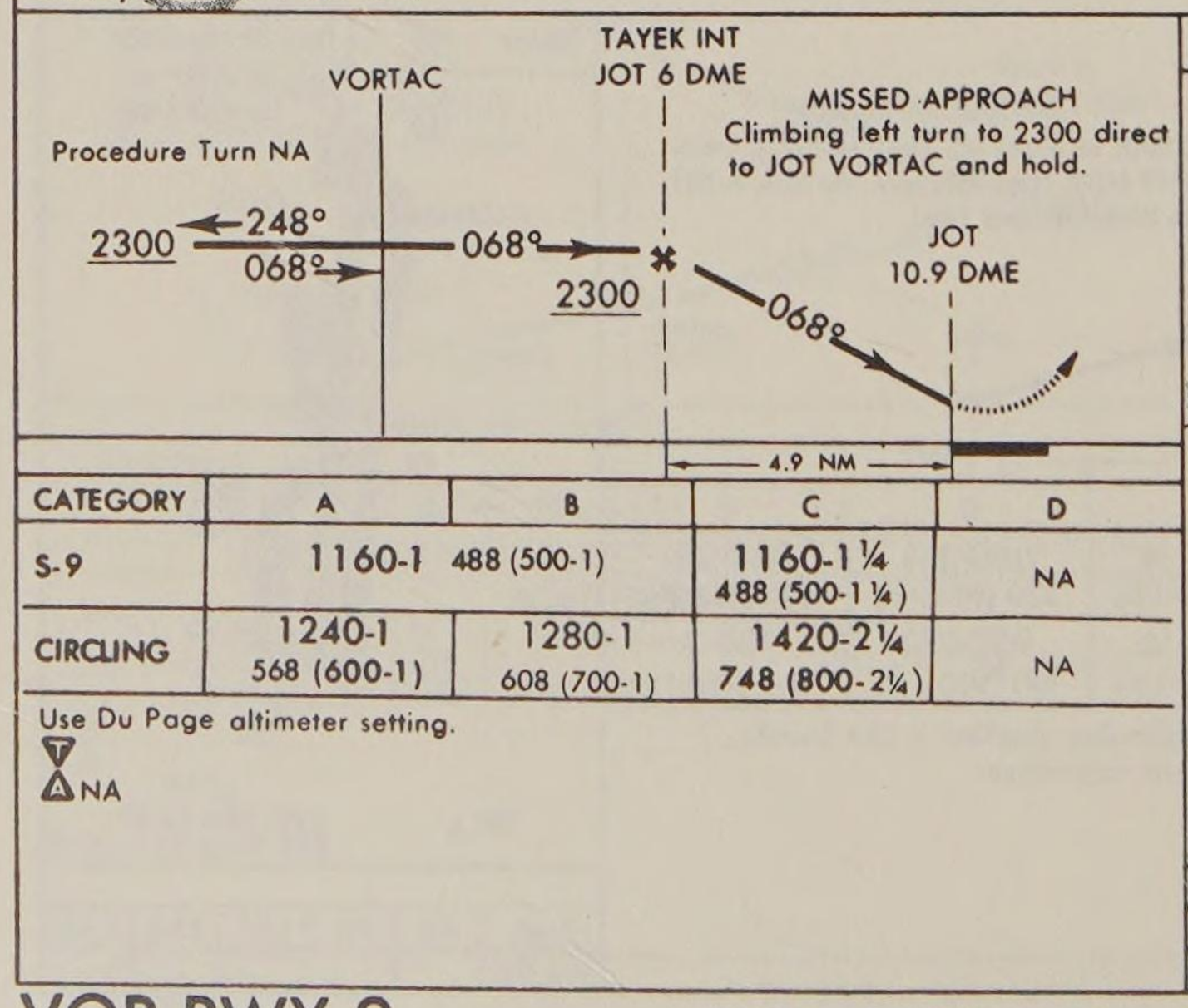
Not for use in Navigation

Amdt 1

VOR RWY 9

ROMEOVILLE/LEWIS UNIVERSITY (LOT)
ROMEOVILLE, ILLINOIS



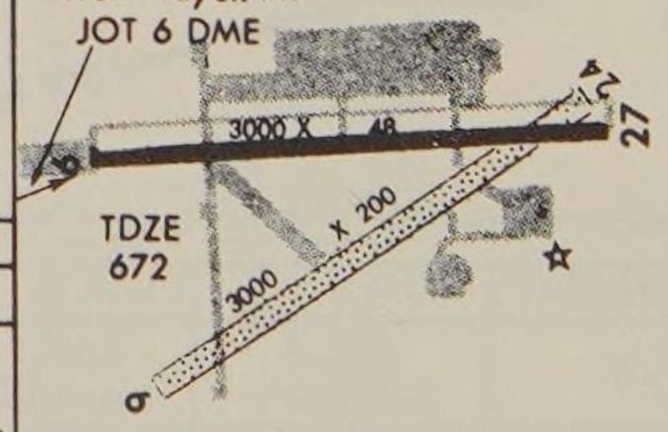


CATEGORY	A	B	C	D
S-9	1160-1 488 (500-1)		1160-1¼ 488 (500-1¼)	NA
CIRCLING	1240-1 568 (600-1)	1280-1 608 (700-1)	1420-2¼ 748 (800-2¼)	NA

Use Du Page altimeter setting.

T
A NA

ELEV 672



REIL Rwy 27
LIRL Rwy 9-27

FAF to MAP 4.9 NM					
Knots	60	90	120	150	180
Min:Sec	4:54	3:16	2:27	1:58	1:38

VOR RWY 9

41°36'N – 88°05'W

ROMEOVILLE, ILLINOIS
ROMEOVILLE/LEWIS UNIVERSITY (LOT)

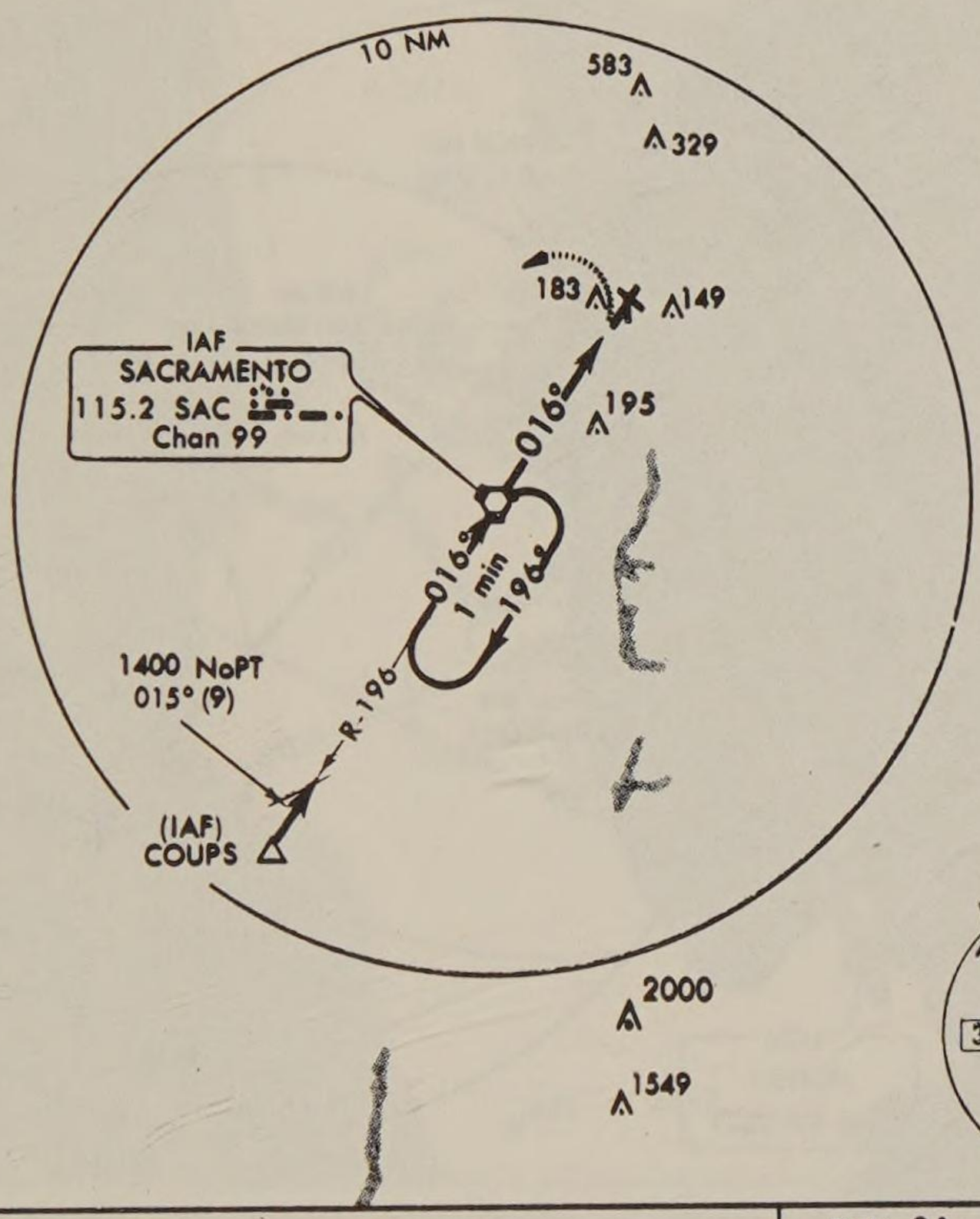
Not for use in Navigation

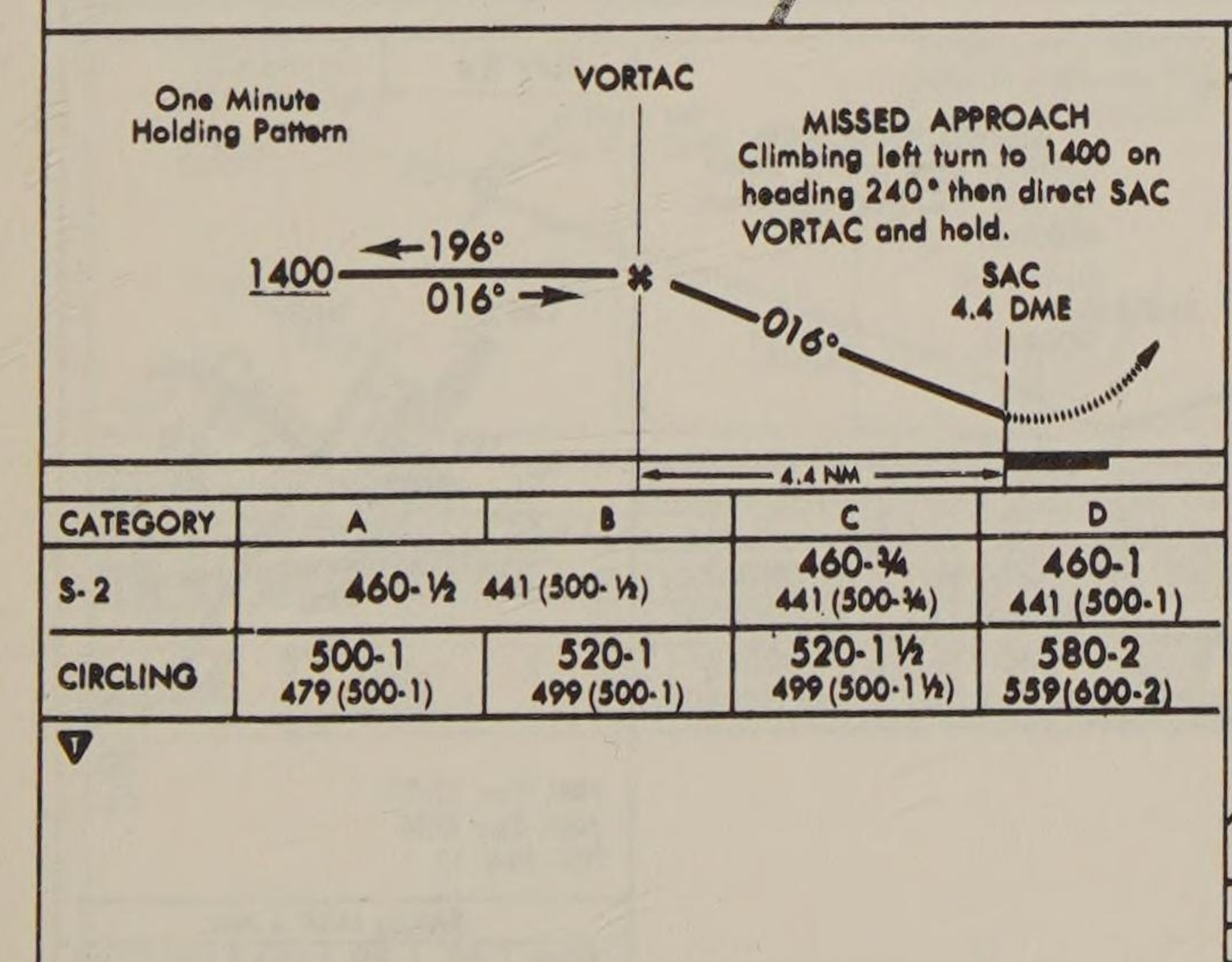
Amdt 9

VOR RWY 2

SACRAMENTO EXECUTIVE (SAC)
SACRAMENTO, CALIFORNIA

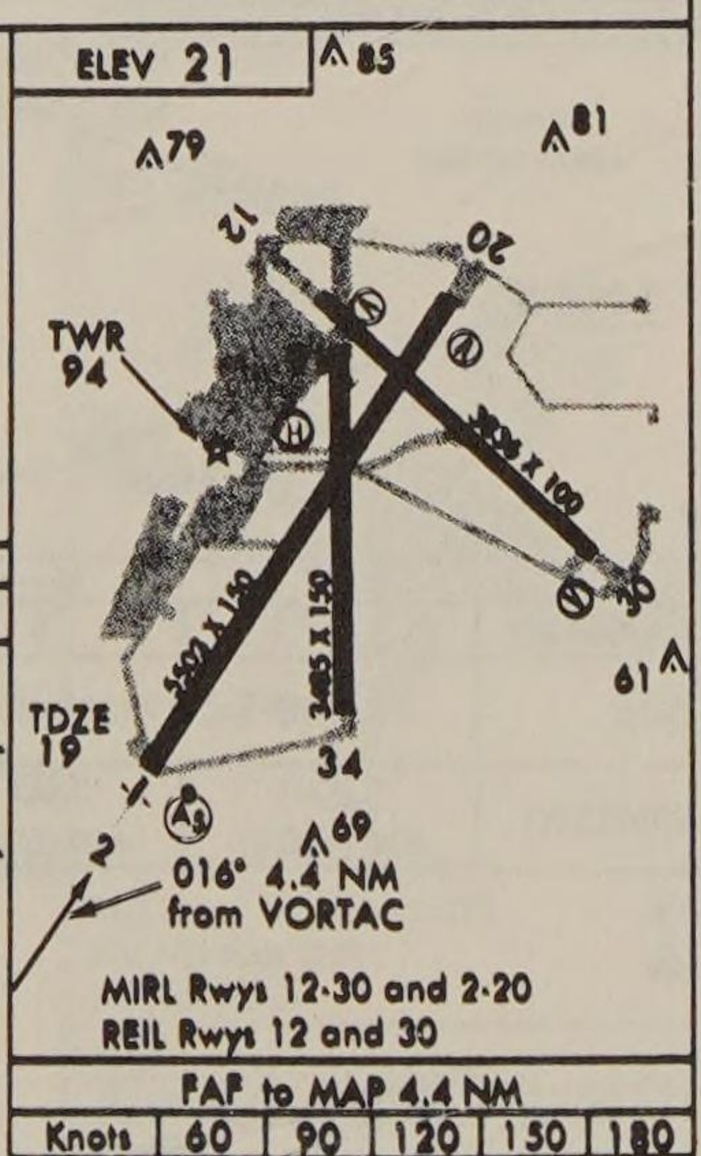
SACRAMENTO APP CON
118.8 363.8
SACRAMENTO TOWER ★
119.5 (CTAF) 257.8
GND CON
125.0
ATIS ★ 125.5
UNICOM 122.95





CATEGORY	A	B	C	D
S-2	460-½ 441 (500-½)		460-¾ 441 (500-¾)	460-1 441 (500-1)
CIRCLING	500-1 479 (500-1)	520-1 499 (500-1)	520-1½ 499 (500-1½)	580-2 559 (600-2)

▼



FAF to MAP 4.4 NM					
Knots	60	90	120	150	180
Min:Sec	4:24	2:56	2:12	1:46	1:28

VOR RWY 2

38°31'N – 121°30'W

SACRAMENTO, CALIFORNIA
SACRAMENTO EXECUTIVE (SAC)

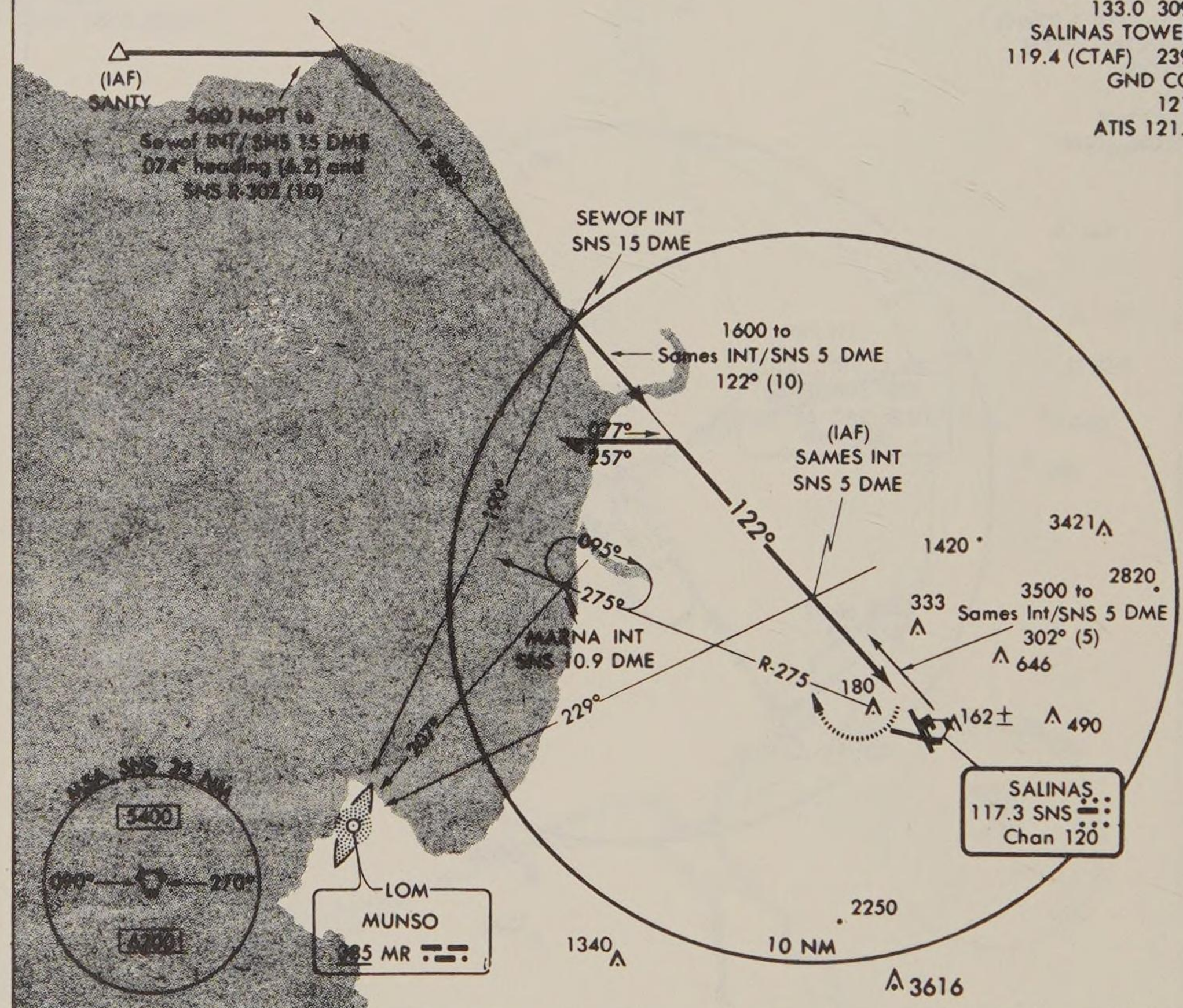
Not for use in Navigation

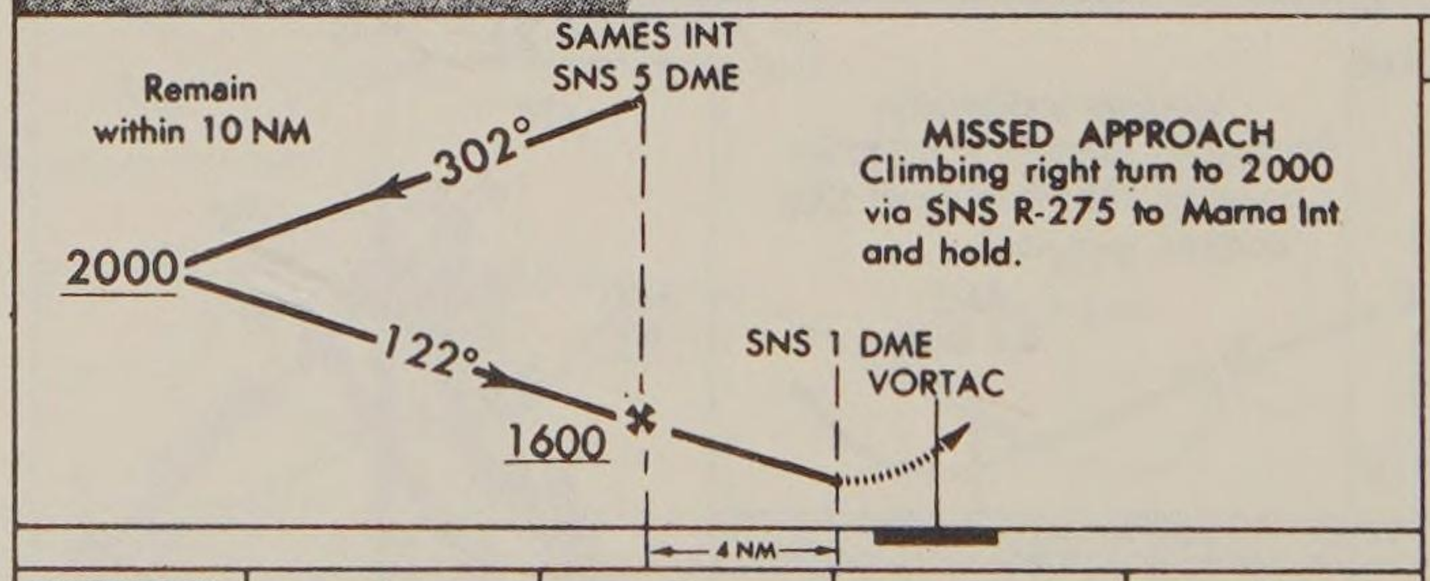
Amdt 9

VOR RWY 13

SALINAS MUNI (SNS)
SALINAS, CALIFORNIA

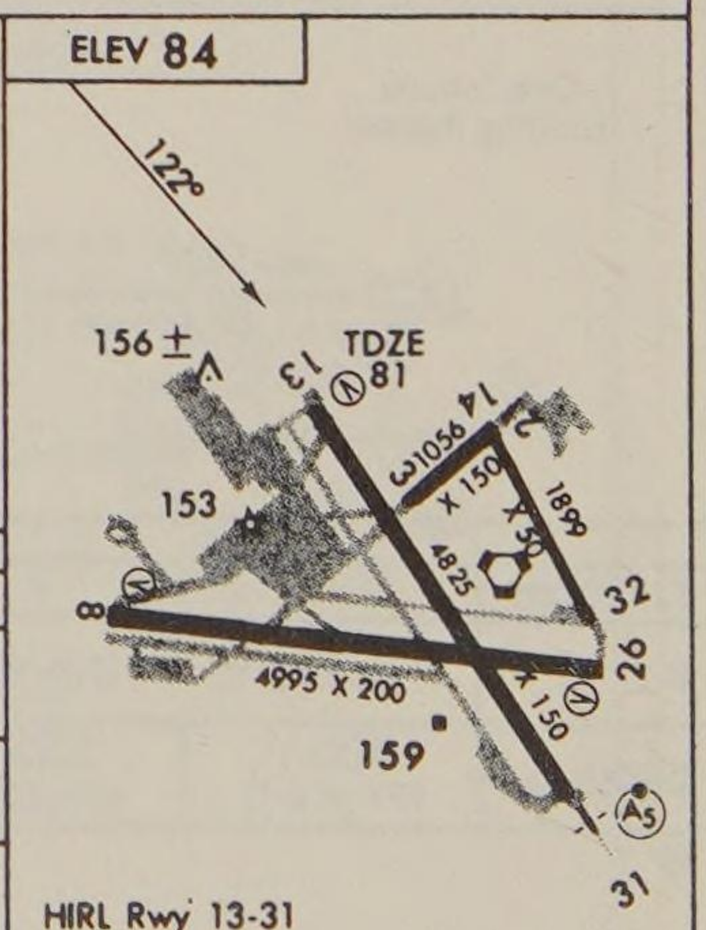
MONTEREY APP CON
133.0 309.2
SALINAS TOWER★
119.4 (CTAF) 239.3
GND CON
121.7
ATIS 121.15





MISSED APPROACH
Climbing right turn to 2000
via SNS R-275 to Marna Int
and hold.

CATEGORY	A	B	C	D
S-13	500-1 419 (500-1)		500-1¼ 419 (500-1¼)	1020-3 939 (1000-3)
CIRCLING	520-1 436 (500-1)	540-1 456 (500-1)	540-1½ 456 (500-1½)	1020-3 936 (1000-3)



HIRL Rwy 13-31
MIRL Rwy 8-26
REIL Rwy 13

FAF to MAP 4 NM					
Knots	60	90	120	150	180
Min:Sec	4:00	2:40	2:00	1:36	1:20

VOR RWY 13

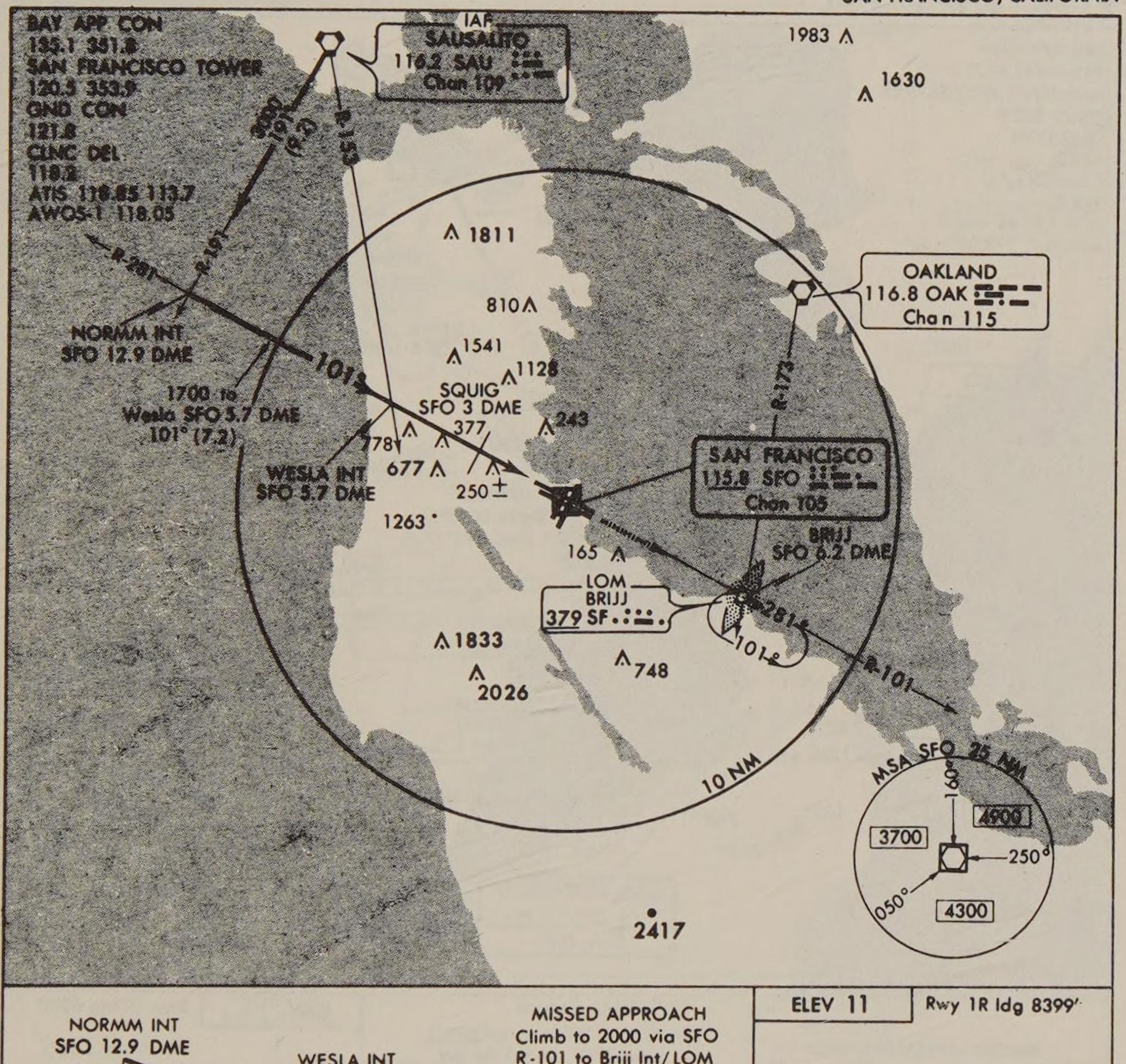
36°40'N-121°36'W

SALINAS, CALIFORNIA
SALINAS MUNI (SNS)

Not for use in Navigation

Amdt 5
VOR-B

SAN FRANCISCO INTERNATIONAL (SFO)
SAN FRANCISCO, CALIFORNIA

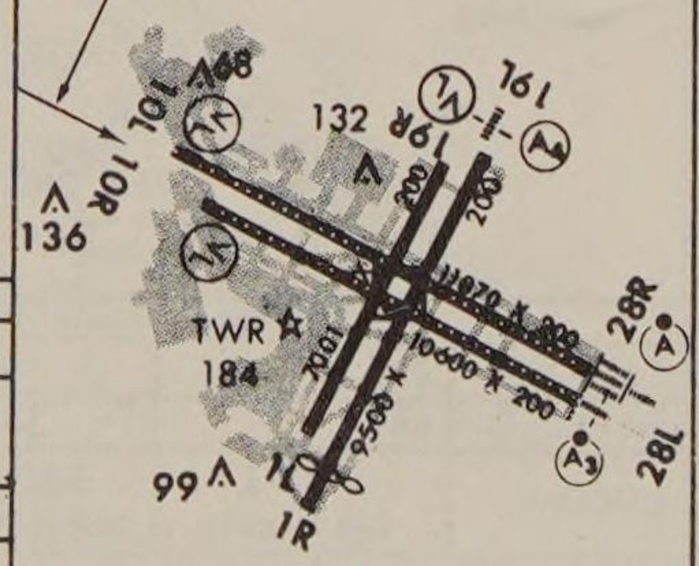


NORMM INT
SFO 12.9 DME
3000
101°
WESLA INT
SFO 5.7 DME
SQUIG
SFO 3 DME
1700
*1080
VOR/DME
Procedure Turn
NA
*CAT D 1180'

MISSED APPROACH
Climb to 2000 via SFO
R-101 to Brijj Int/LOM
and hold.

CATEGORY	A	B	C	D
CIRCLING	1080-1¼ 1069 (1100-1¼)	1080-1½ 1069 (1100-1½)	1080-3 1069 (1100-3)	1180-3 1169 (1200-3)
DME MINIMA				
CIRCLING	780-1 769 (800-1)	960-1¼ 949 (1000-1¼)	1000-3 989 (1000-3)	1180-3 1169 (1200-3)

ELEV 11 | Rwy 1R ldg 8399'



REIL Rwys 1L, 1R and 10L
TDZ/CL Rwy 28R
HIRL all Rwys

Knots	60	90	120	150	180
Min:Sec					

VOR-B

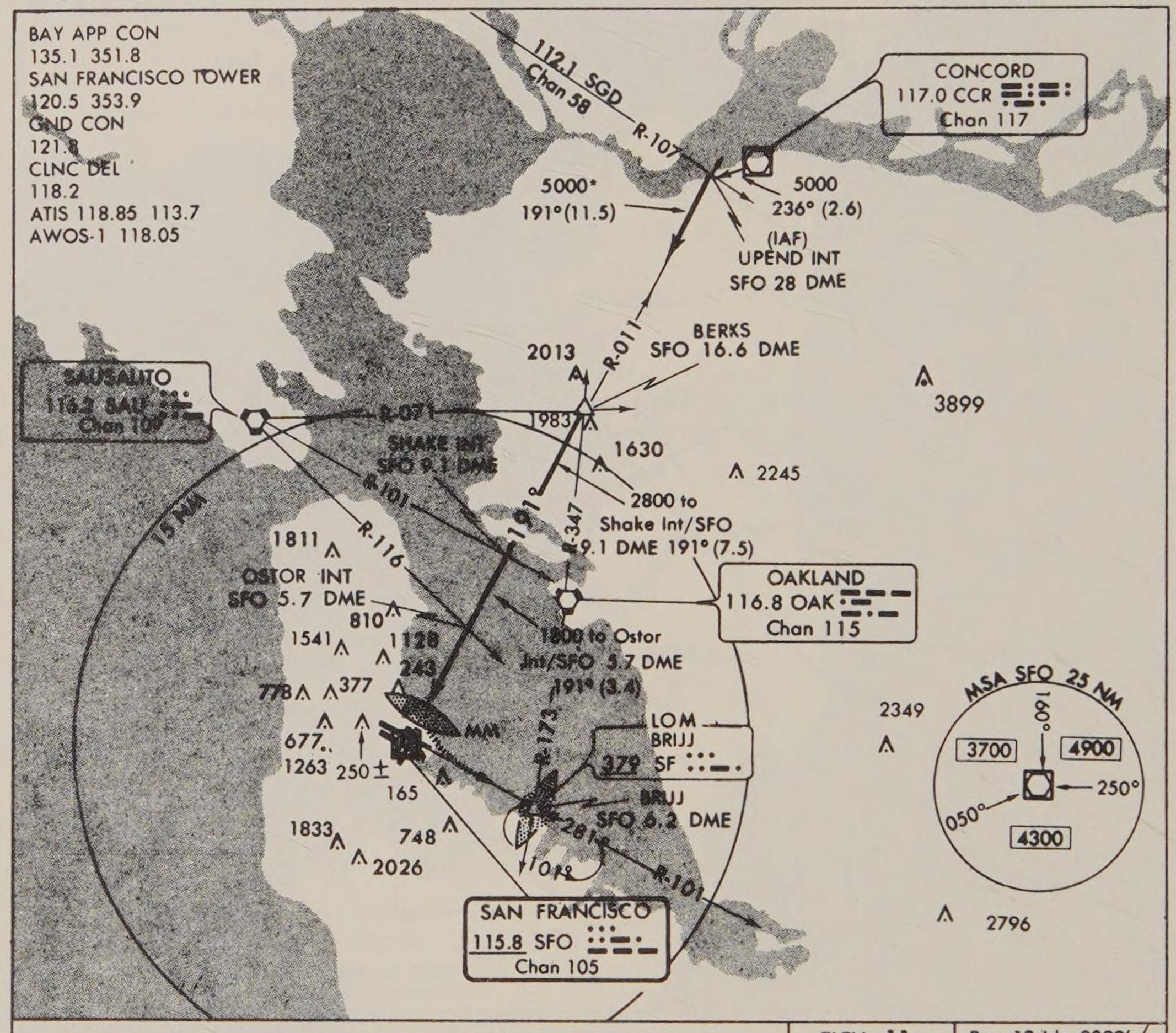
37°37'N – 122°23'W
SAN FRANCISCO, CALIFORNIA
SAN FRANCISCO INTERNATIONAL (SFO)

Not for use in Navigation

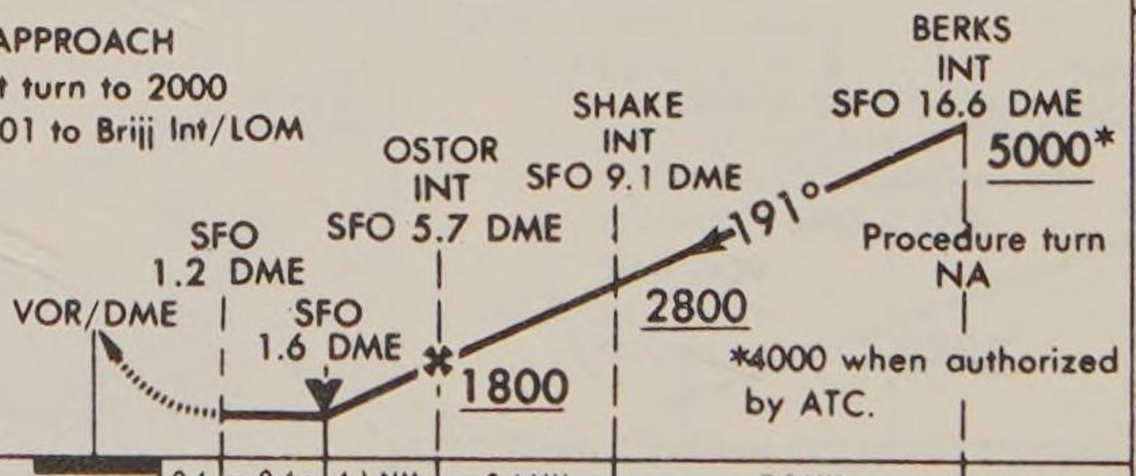
Amdt 7

VOR RWY 19L

SAN FRANCISCO INTERNATIONAL (SFO)
SAN FRANCISCO, CALIFORNIA



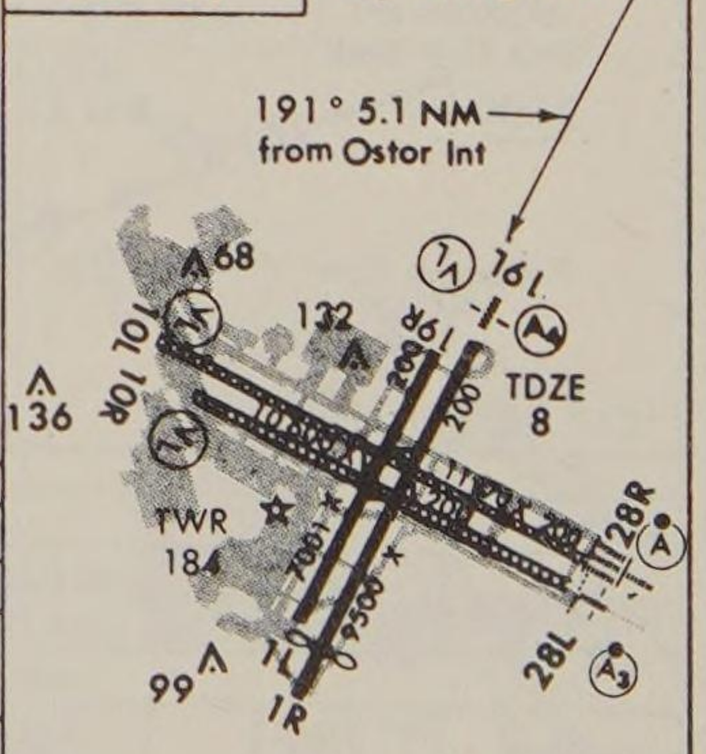
MISSED APPROACH
Climbing left turn to 2000
via SFO R-101 to Brijj Int/LOM
and hold.



CATEGORY	A	B	C	D
S-19L	340/50 332(400-1)			
CIRCLING	780-1 769 (800-1)	960-1¼ 949 (1000-1¼)	1000-3 989 (1000-3)	1180-3 1169 (1200-3)

Inoperative table does not apply.

ELEV 11 — Rwy 1R ldg 8399'



▲187

REIL Rwys 1L, 1R and 10L
TDZ/CL Rwy 28R
HIRL all Rwys

FAF to MAP 4.5 NM					
Knots	60	90	120	150	180
Min:Sec	4:30	3:00	2:15	1:48	1:30

VOR RWY 19L

37°37'N-122°23'W

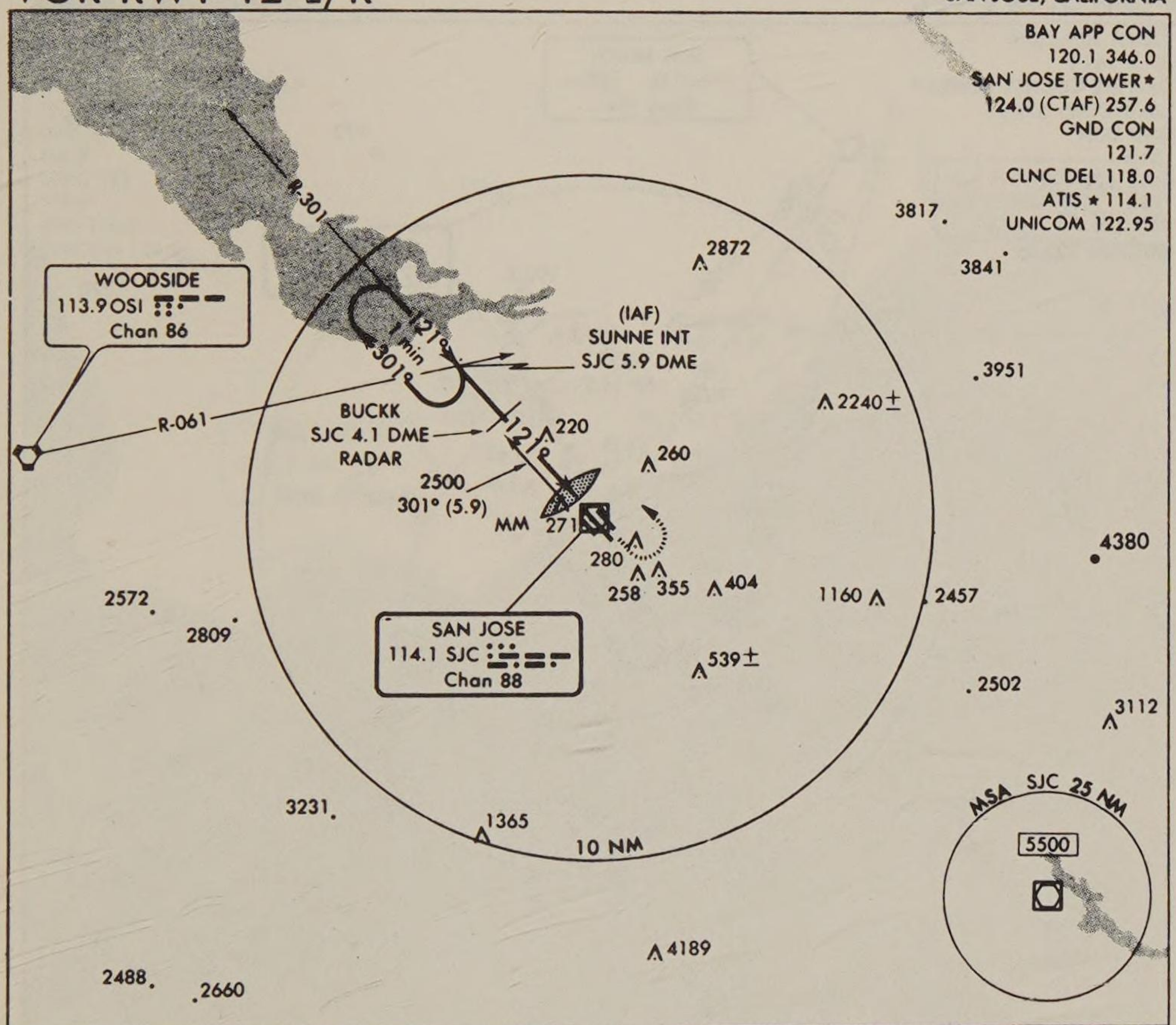
SAN FRANCISCO, CALIFORNIA
SAN FRANCISCO INTERNATIONAL (SFO)

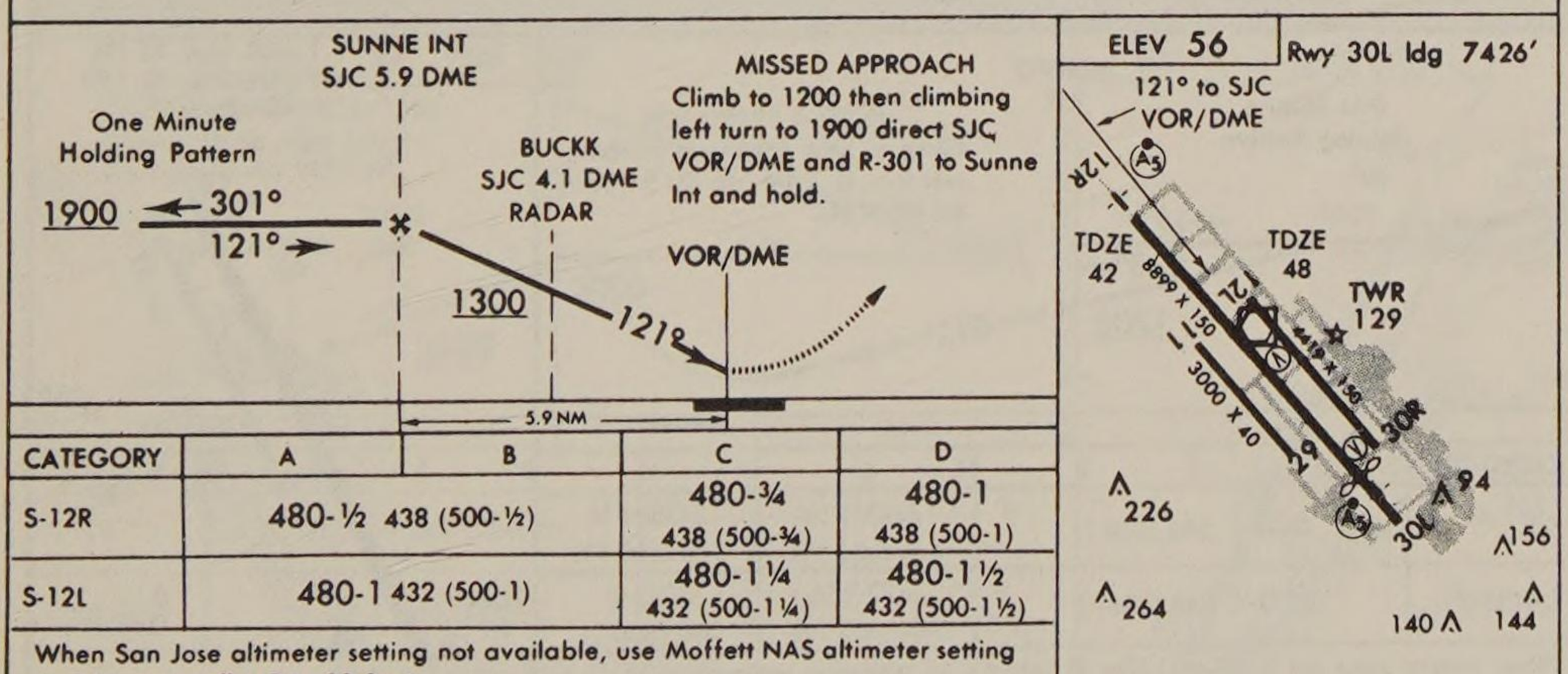
Not for use in Navigation

Amdt 17

VOR RWY 12 L/R

SAN JOSE INTL (SJC)
SAN JOSE, CALIFORNIA





CATEGORY	A	B	C	D
S-12R	480-½ 438 (500-½)		480-¾ 438 (500-¾)	480-1 438 (500-1)
S-12L	480-1 432 (500-1)		480-1¼ 432 (500-1¼)	480-1½ 432 (500-1½)

When San Jose altimeter setting not available, use Moffett NAS altimeter setting and increase all MDAs 20 feet.
DME or Radar required.

MIRL Rwy 12L-30R
HIRL Rwy 12R-30L

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 12 L/R 37°21'N-121°55'W SAN JOSE, CALIFORNIA
SAN JOSE INTL (SJC)

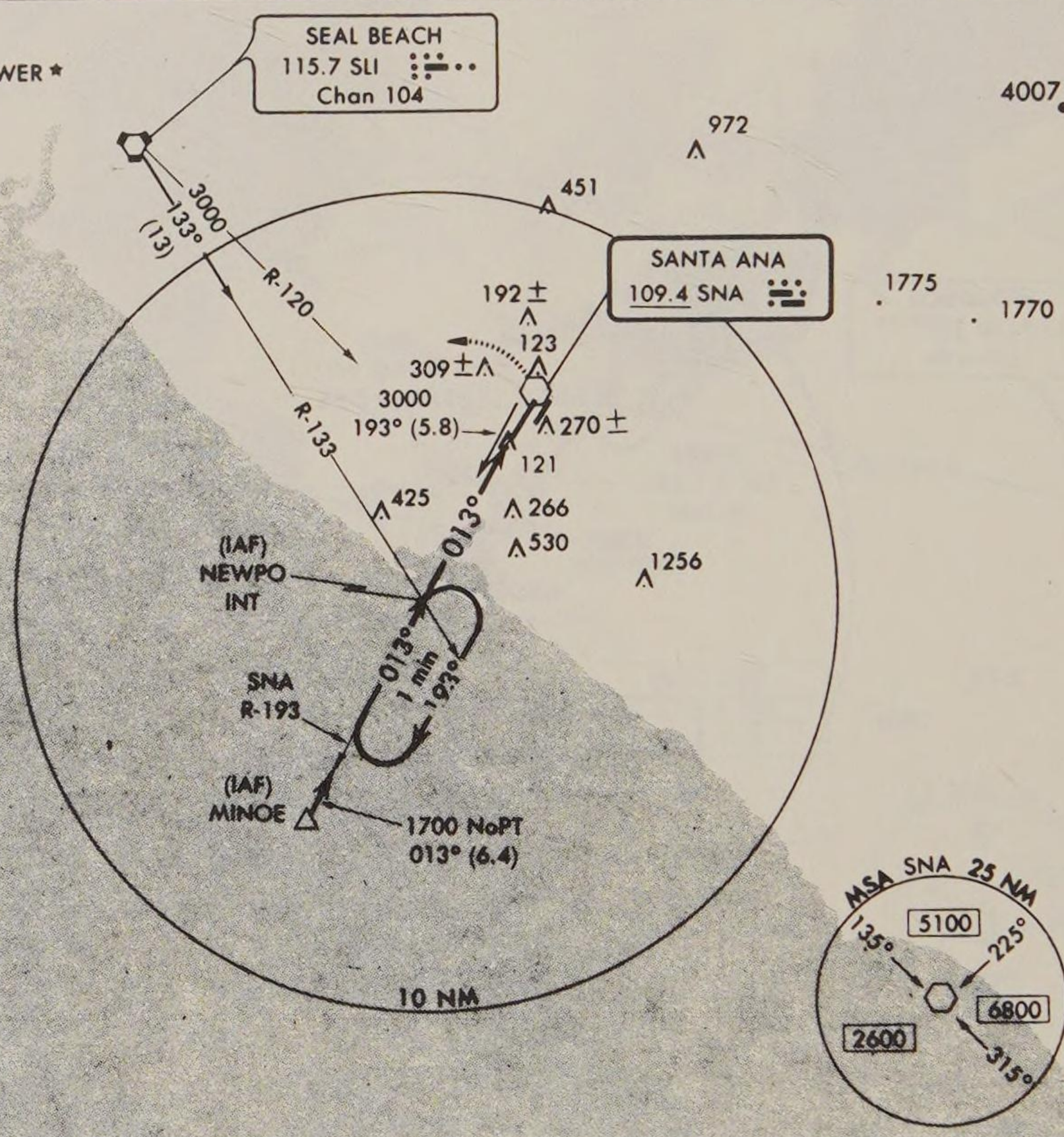
Not for use in Navigation

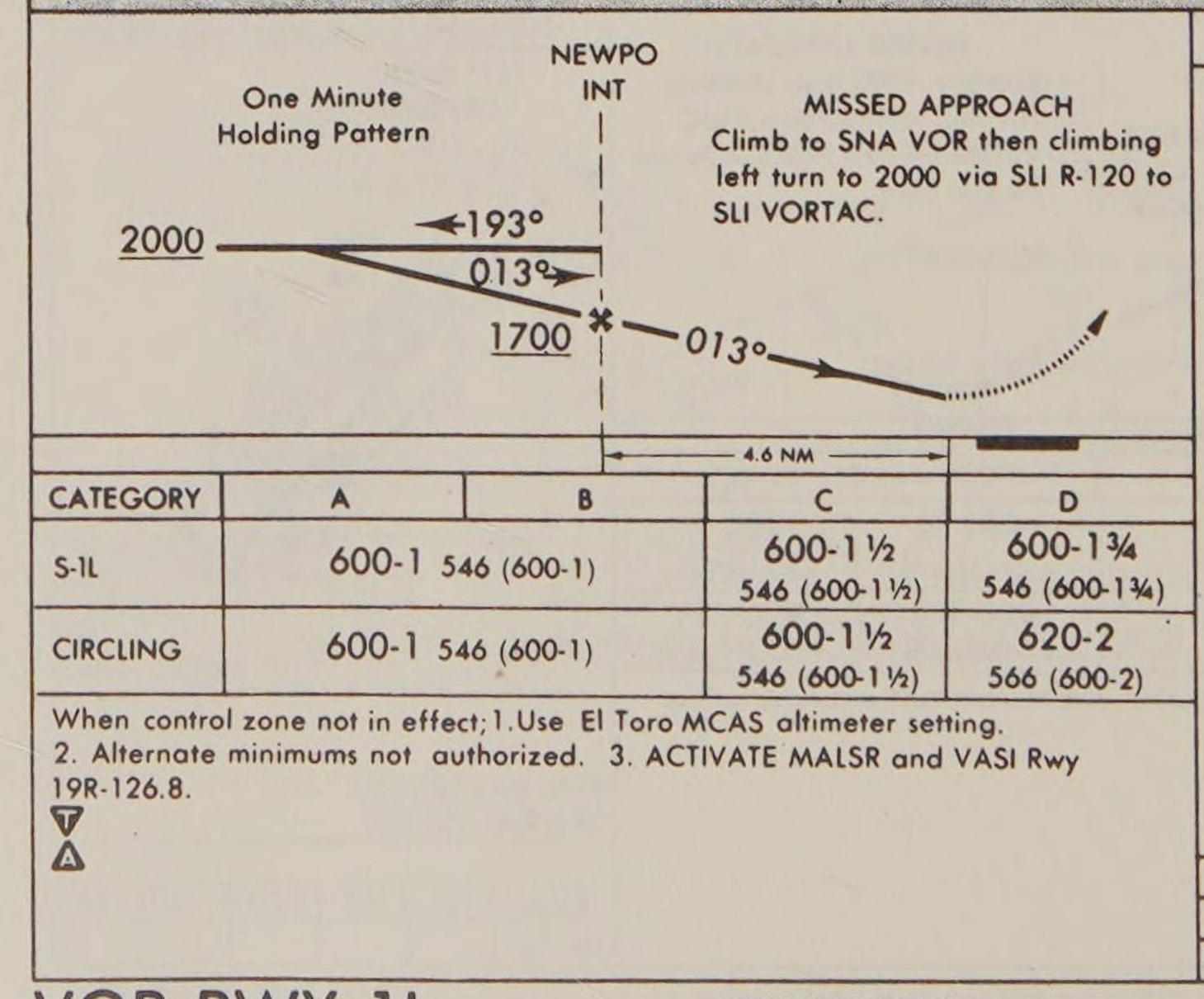
Amdt 2

VOR RWY 1L

SANTA ANA/JOHN WAYNE ARPT-ORANGE CO (SNA)
SANTA ANA, CALIFORNIA

COAST APP CON
121.3 263.1
ORANGE COUNTY TOWER *
126.8 (CTAF) 379.9
GND CON
120.8
CLNC DEL
118.0
ATIS 126.0
UNICOM 122.95





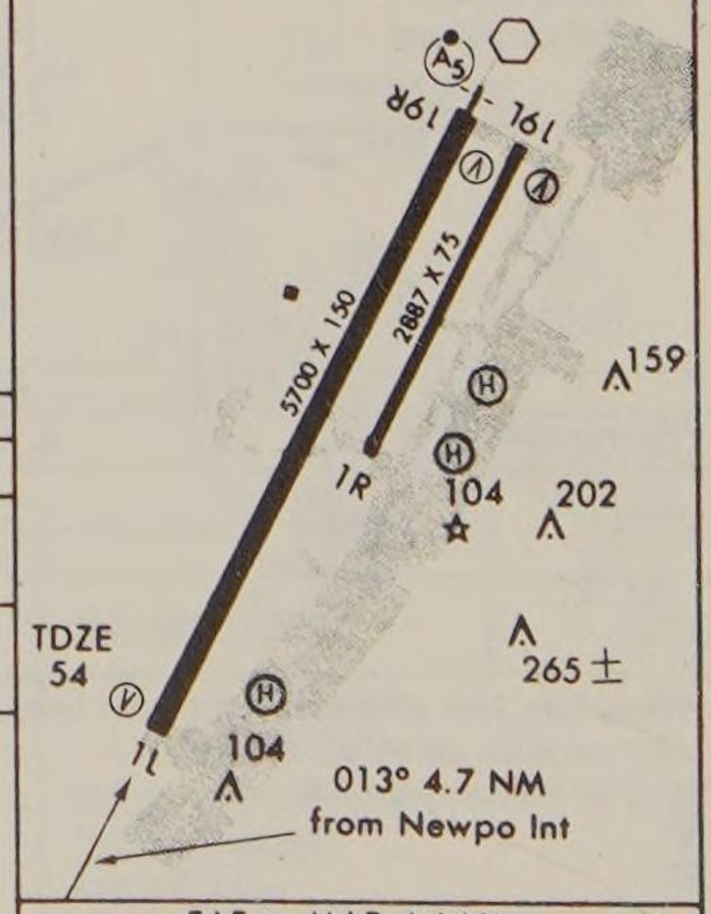
CATEGORY	A	B	C	D
S-1L	600-1 546 (600-1)		600-1½ 546 (600-1½)	600-1¾ 546 (600-1¾)
CIRCLING	600-1 546 (600-1)		600-1½ 546 (600-1½)	620-2 566 (600-2)

When control zone not in effect; 1. Use El Toro MCAS altimeter setting. 2. Alternate minimums not authorized. 3. ACTIVATE MALSR and VASI Rwy 19R-126.8.

T
A

ELEV 54

MIRL Rwy 1R-19L
HIRL Rwy 1L-19R
REIL Rwy 19L



FAF to MAP 4.6 NM					
Knots	60	90	120	150	180
Min:Sec	4:36	3:04	2:18	1:50	1:32

VOR RWY 1L

33°40'N-117°52'W
SANTA ANA, CALIFORNIA
SANTA ANA/JOHN WAYNE ARPT-ORANGE CO (SNA)

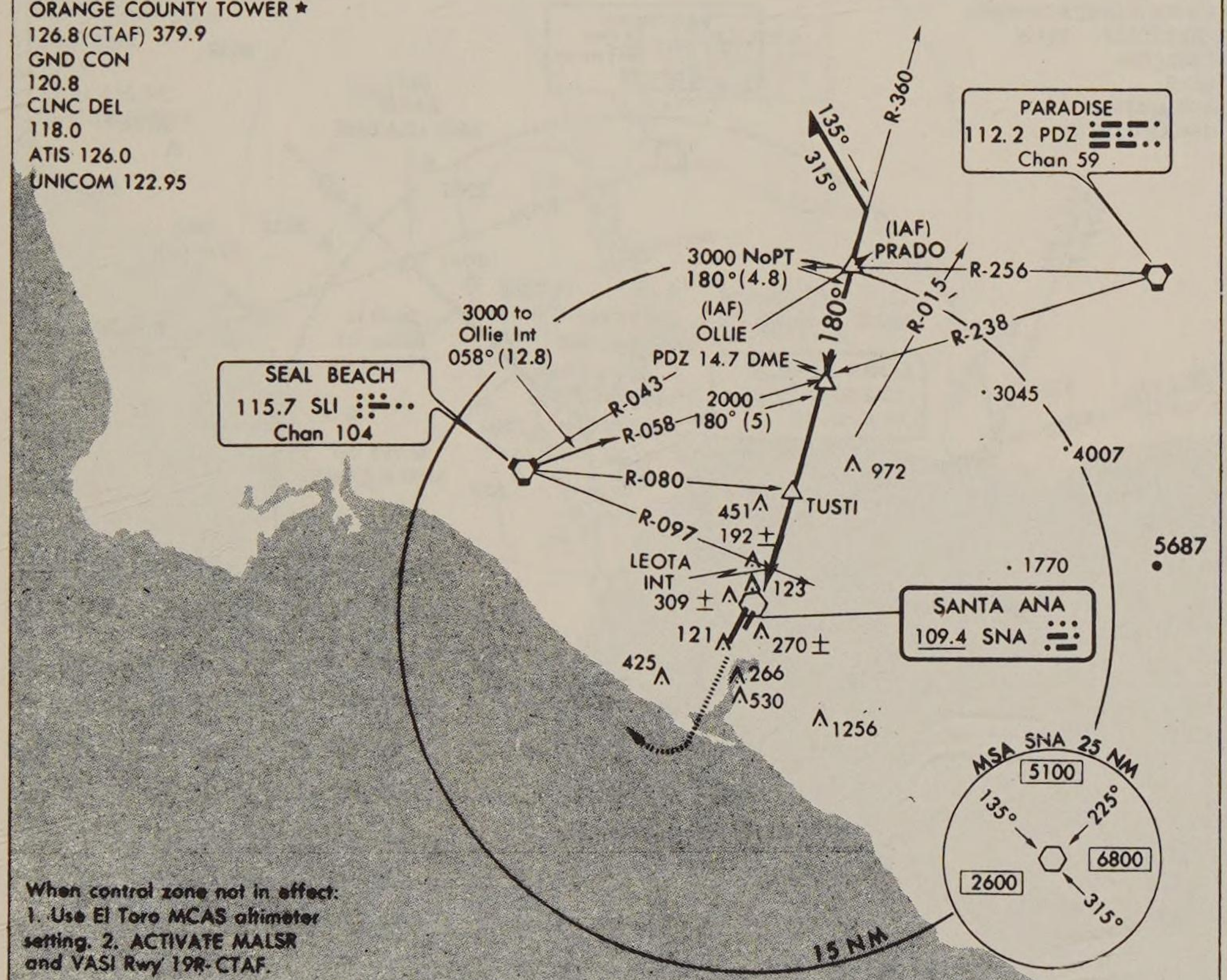
Not for use in Navigation

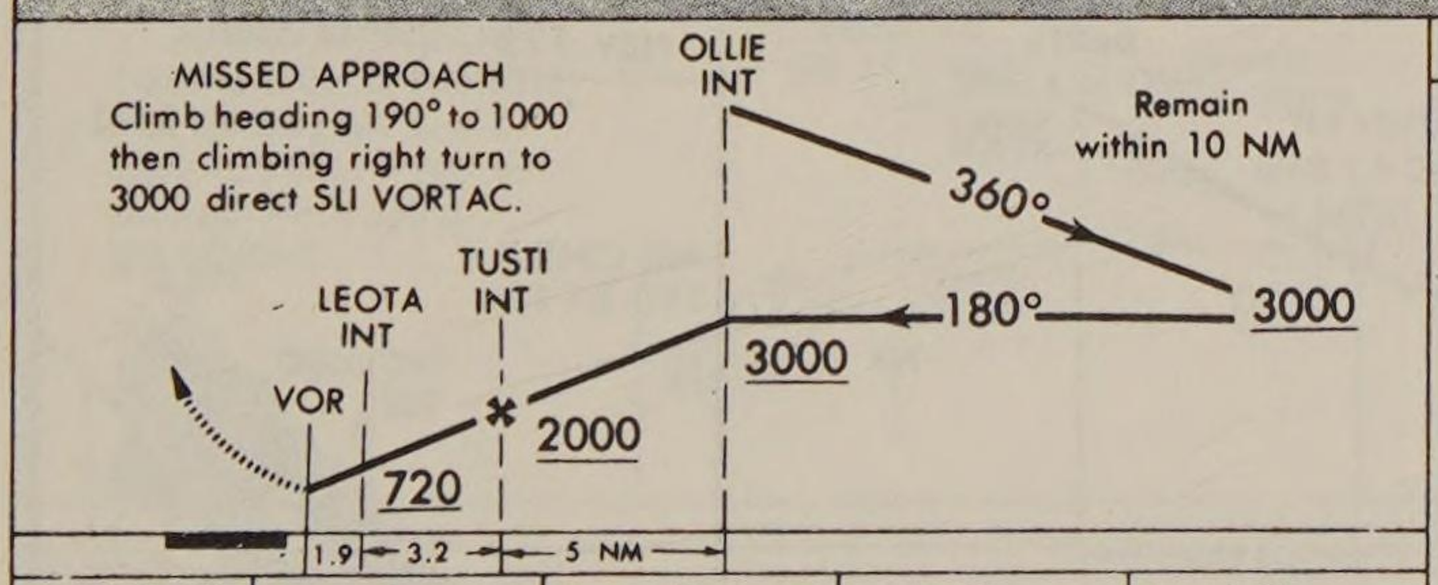
Amdt 23

VOR RWY 19R

SANTA ANA/JOHN WAYNE ARPT-ORANGE CO (SNA)
SANTA ANA, CALIFORNIA

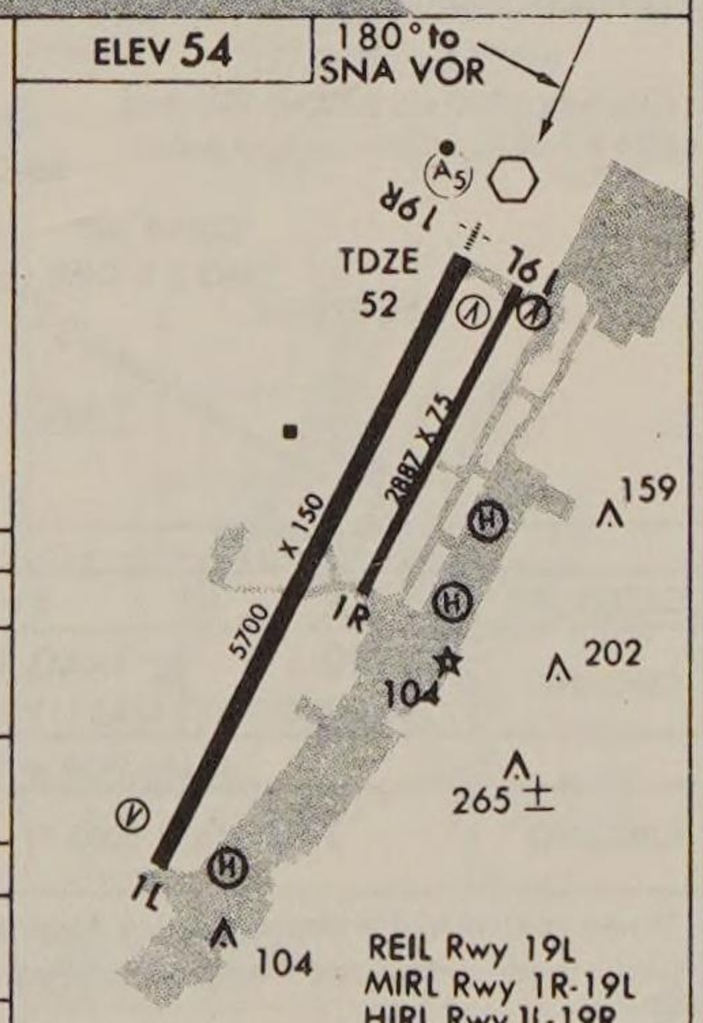
COAST APP CON
121.3 263.1
ORANGE COUNTY TOWER ★
126.8 (CTAF) 379.9
GND CON
120.8
CLNC DEL
118.0
ATIS 126.0
UNICOM 122.95





CATEGORY	A	B	C	D
S-19R	720/24 668 (700-½)		720/60 668 (700-1¼)	720-1½ 668 (700-1½)
CIRCLING	720-1 666 (700-1)		720-1¾ 666 (700-1¾)	720-2 666 (700-2)
DUAL VOR MINIMUMS				
S-19R*	460/24 408 (500-½)		460/40 408 (500-¾)	460/50 408 (500-1)
CIRCLING	600-1 546 (600-1)		600-1½ 546 (600-1½)	620-2 566 (600-2)

* Cat. D S-19R visibility increased to RVR 6000 for inoperative MALSR TVA



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 19R

33° 40′N-117° 52′W
SANTA ANA, CALIFORNIA
SANTA ANA/JOHN WAYNE ARPT-ORANGE CO (SNA)

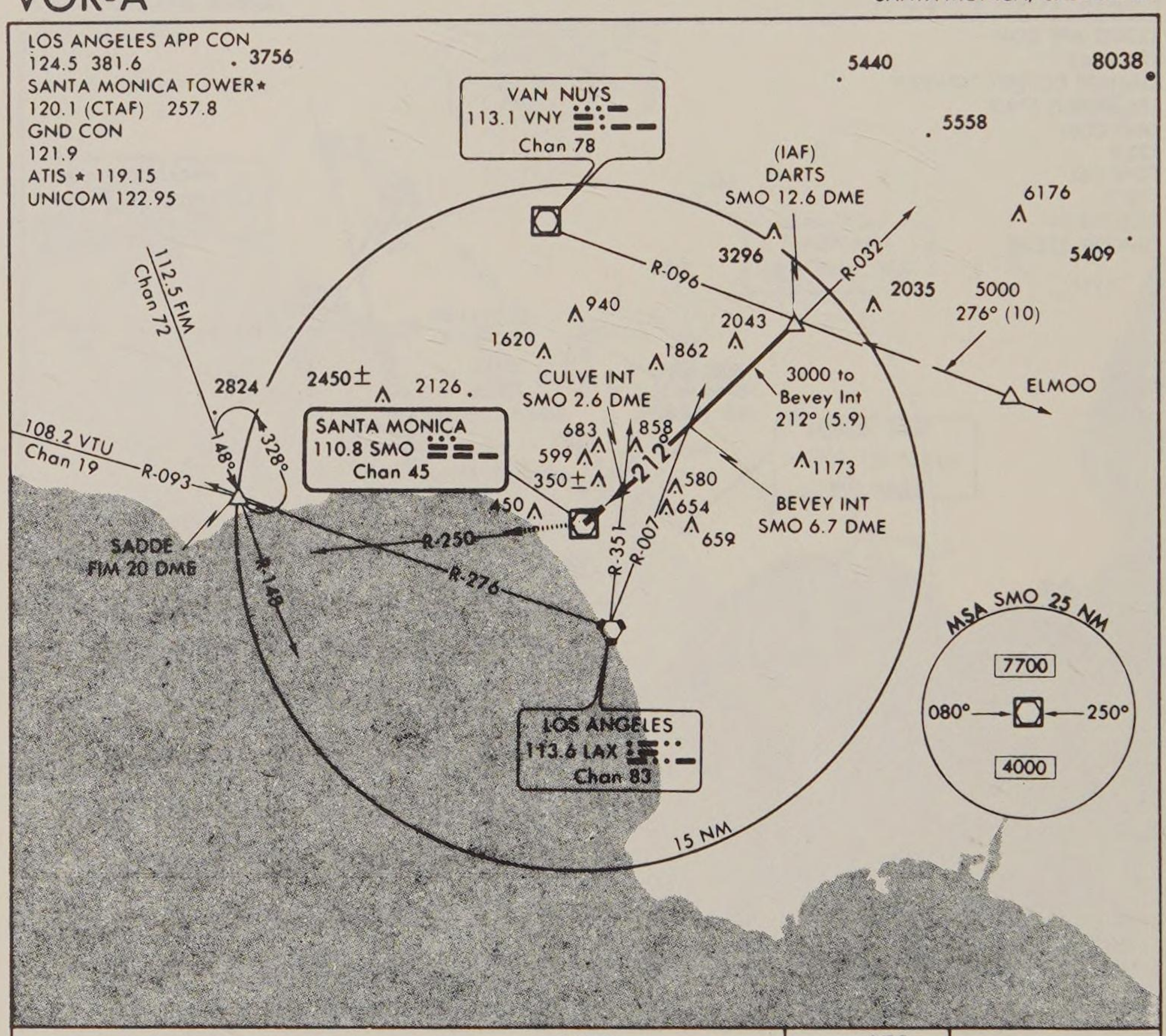
Not for use in Navigation

Amdt 6

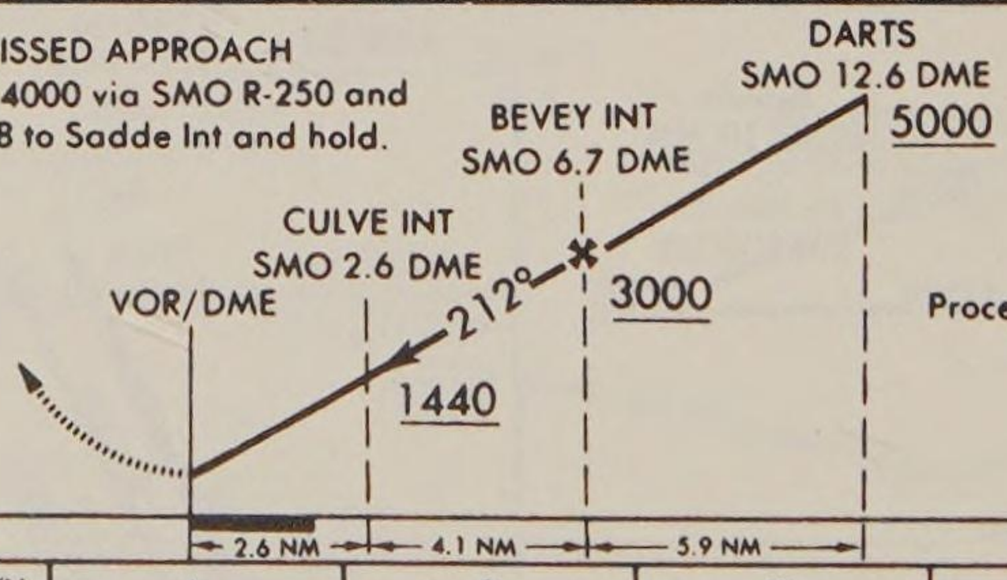
VOR-A

SANTA MONICA MUNI (SMO)
SANTA MONICA, CALIFORNIA

LOS ANGELES APP CON
124.5 381.6 . 3756
SANTA MONICA TOWER★
120.1 (CTAF) 257.8
GND CON
121.9
ATIS ★ 119.15
UNICOM 122.95

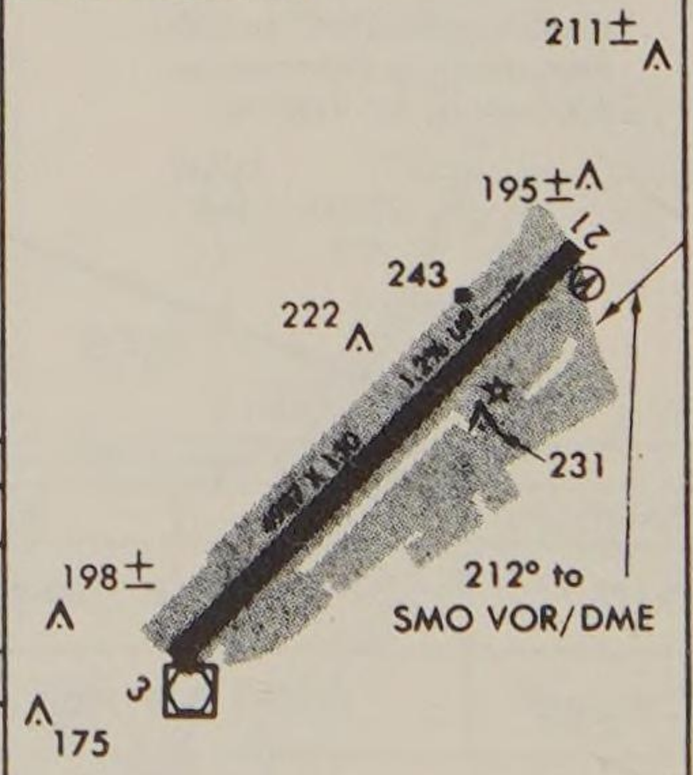


MISSED APPROACH
Climb to 4000 via SMO R-250 and FIM R-148 to Sadde Int and hold.



Procedure Turn
NA

ELEV 175



CATEGORY	A	B	C	D
CIRCLING	1440-1¼ 1265 (1300-1¼)	1440-1½ 1265 (1300-1½)	1440-3 1265 (1300-3)	
DUAL VOR or DME MINIMUMS				
CIRCLING	740-1 565 (600-1)		740-1½ 565 (600-1½)	740-2 565 (600-2)

When control tower closed use Los Angeles altimeter setting.
Circling not authorized Northwest of Rwy 3-21.

MIRL Rwy 3-21
REIL Rwy 21

Knots	60	90	120	150	180
Min:Sec					

VOR-A

34°01'N-118°27'W

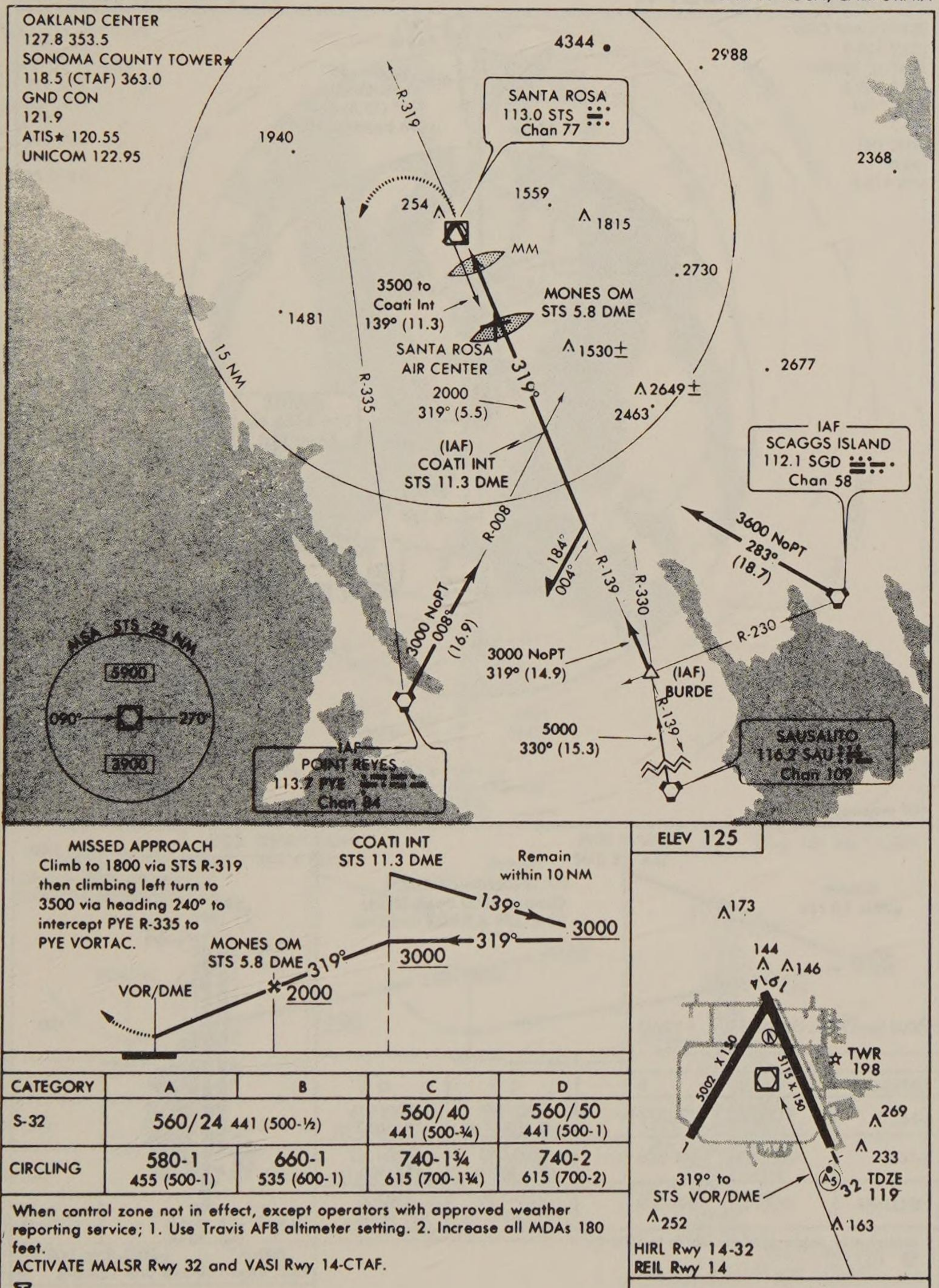
SANTA MONICA, CALIFORNIA
SANTA MONICA MUNI (SMO)

Not for use in Navigation

Amdt 17

VOR RWY 32

SANTA ROSA/SONOMA COUNTY (STS)
SANTA ROSA, CALIFORNIA



MISSED APPROACH
Climb to 1800 via STS R-319 then climbing left turn to 3500 via heading 240° to intercept PYE R-335 to PYE VORTAC.

ELEV 125

CATEGORY	A	B	C	D
S-32	560/24 441 (500-½)		560/40 441 (500-¾)	560/50 441 (500-1)
CIRCLING	580-1 455 (500-1)	660-1 535 (600-1)	740-1¾ 615 (700-1¾)	740-2 615 (700-2)

When control zone not in effect, except operators with approved weather reporting service; 1. Use Travis AFB altimeter setting. 2. Increase all MDAs 180 feet.
ACTIVATE MALSR Rwy 32 and VASI Rwy 14-CTAF.

T
A NA

Knots	60	90	120	150	180
Min:Sec					

VOR RWY 32

38°31′N – 122°49′W

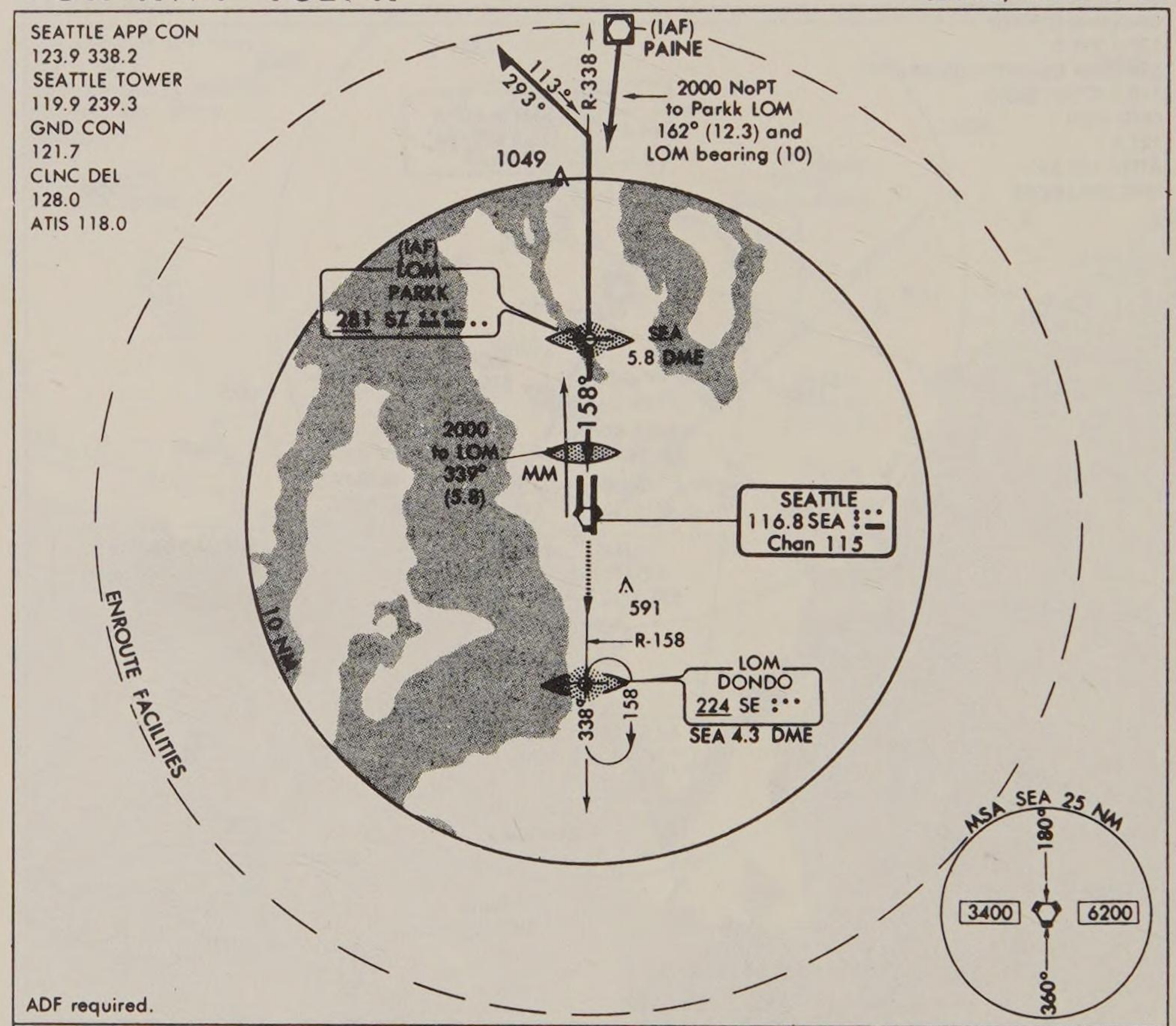
SANTA ROSA, CALIFORNIA
SANTA ROSA/SONOMA COUNTY (STS)

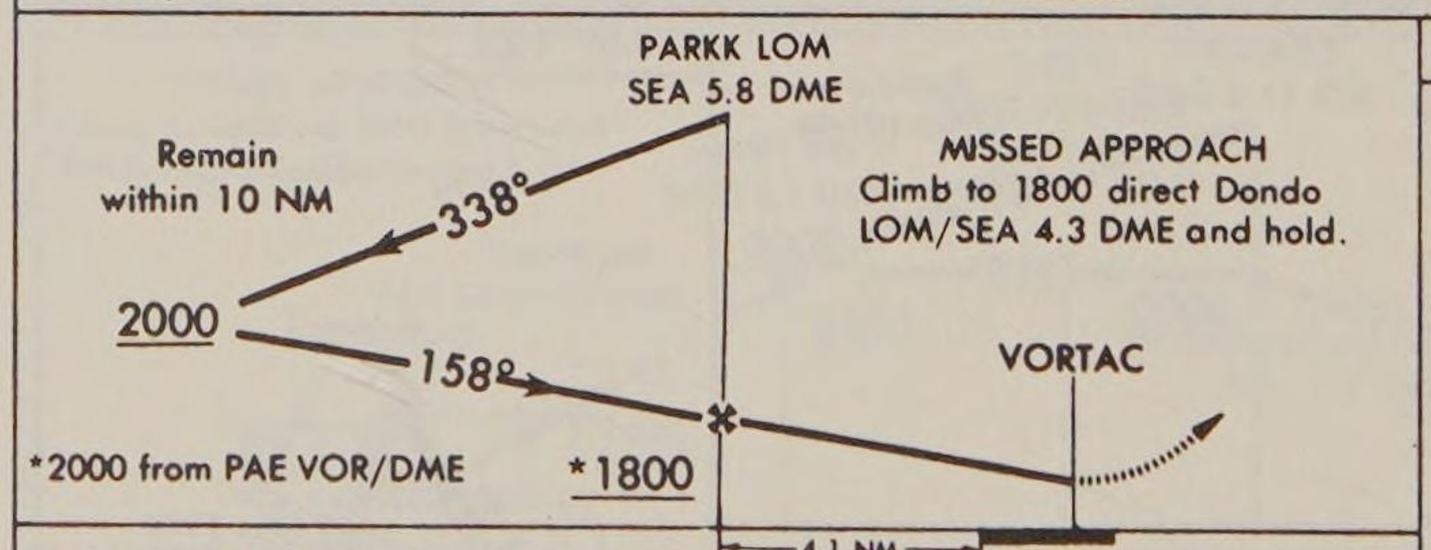
Not for use in Navigation

Amdt 10

VOR RWY 16L/R

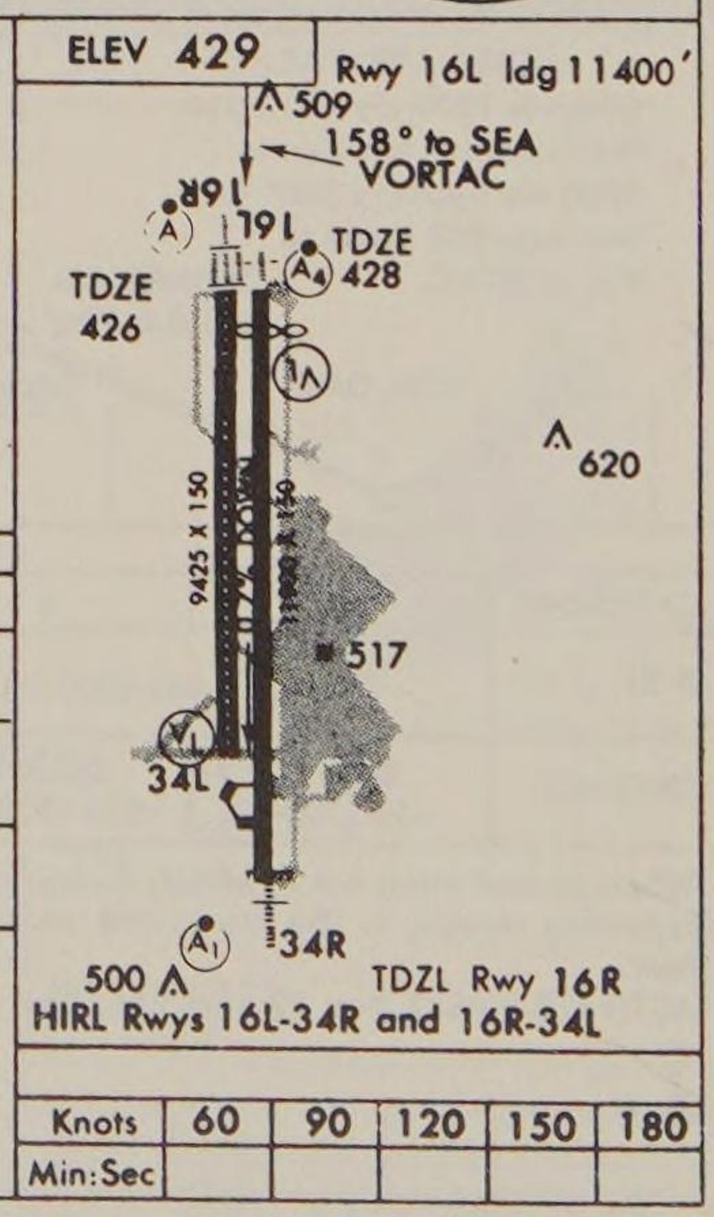
SEATTLE-TACOMA INTL (SEA)
SEATTLE, WASHINGTON





CATEGORY	A	B	C	D
S-16L †	900/40	472 (500-¾)	900/60 472 (500-1¼)	900-1½ 472 (500-1½)
S-16R	900/24	474 (500-½)	900/40 474 (500-¾)	900/50 474 (500-1)
CIRCLING	920-1	491 (500-1)	920-1½ 491 (500-1½)	980-2 551 (600-2)

† Inoperative table does not apply to Cat. C.



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 16L/R

47°27'N – 122°18'W

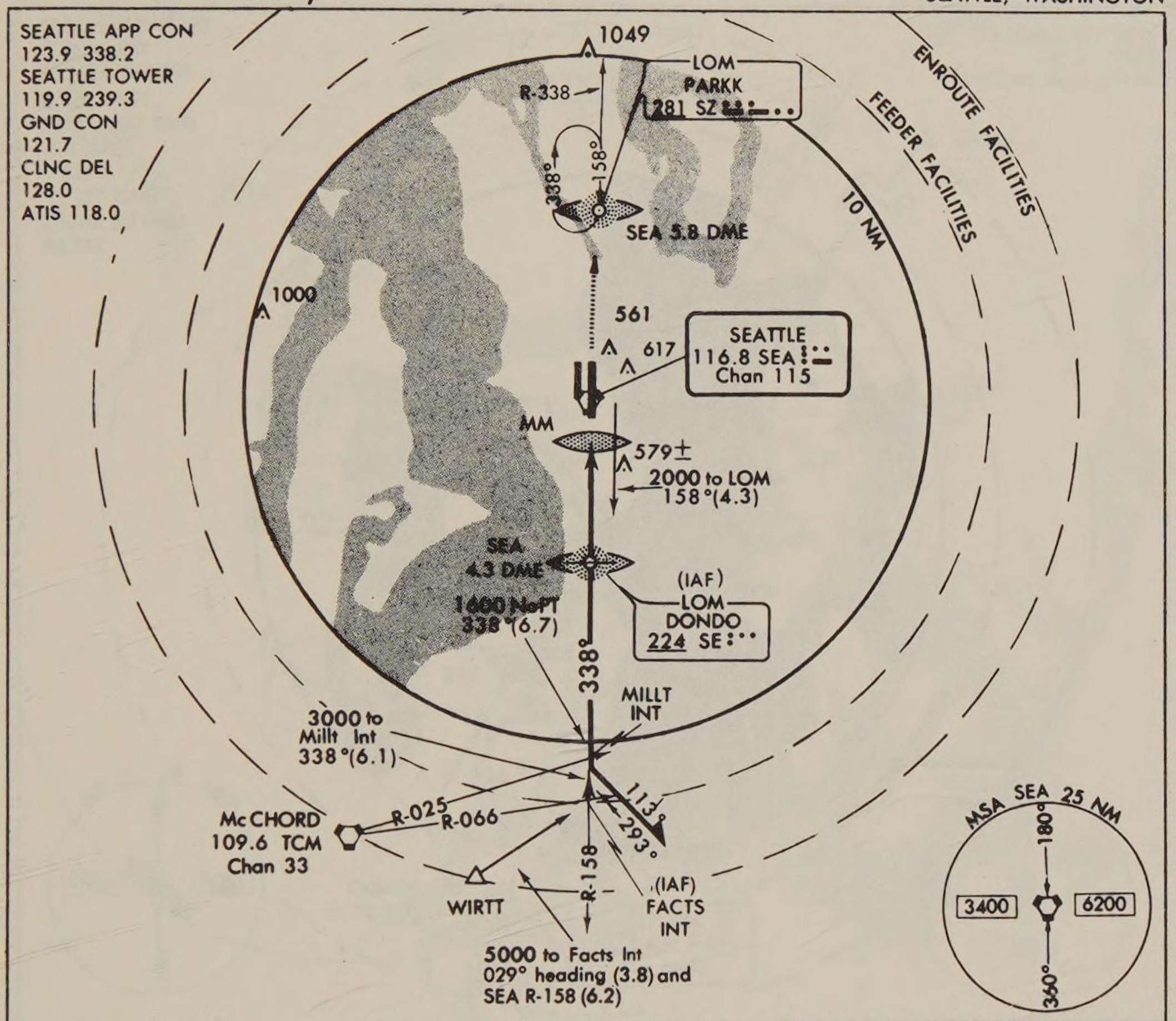
SEATTLE, WASHINGTON
SEATTLE-TACOMA INTL (SEA)

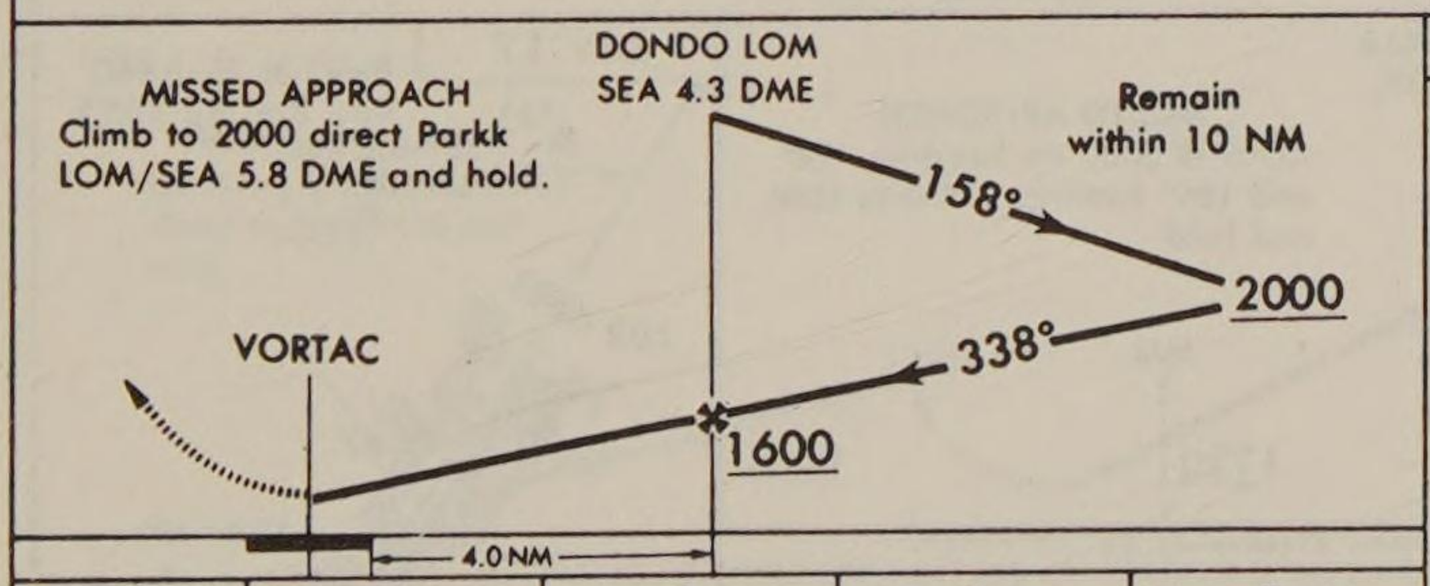
Not for use in Navigation

Amdt 6

VOR RWY 34L/R

SEATTLE-TACOMA INTL (SEA)
SEATTLE, WASHINGTON

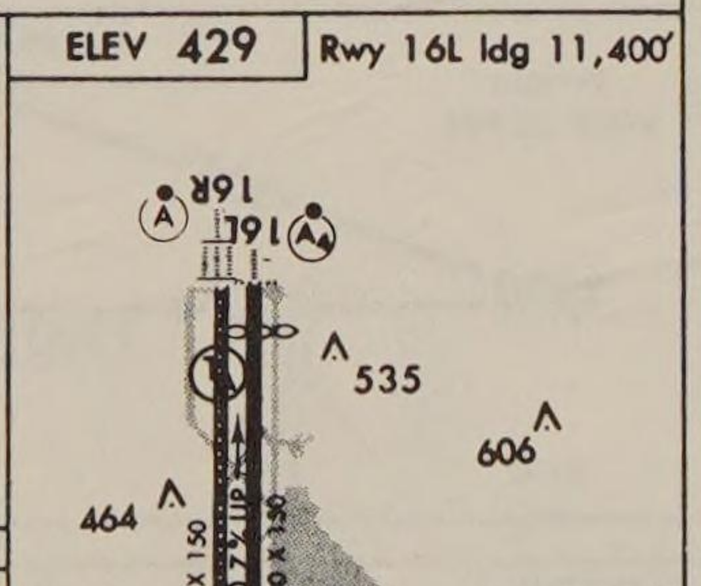




CATEGORY	A	B	C	D
S-34R	840/24 472 (500-½)		840/40 472 (500-¾)	840/50 472 (500-1)
S-34L	840/50 457 (500-1)		840/60 457 (500-1)	840-1½ 457 (500-1½)
CIRCLING	920-1 491 (500-1)		920-1½ 491 (500-1½)	980-2 551 (600-2)

ADF or DME required.

ELEV 429 | Rwy 16L ldg 11,400'



Knots	60	90	120	150	180
Min:Sec					

VOR RWY 34L/R

47°27'N – 122°18'W

SEATTLE, WASHINGTON
SEATTLE-TACOMA INTL (SEA)

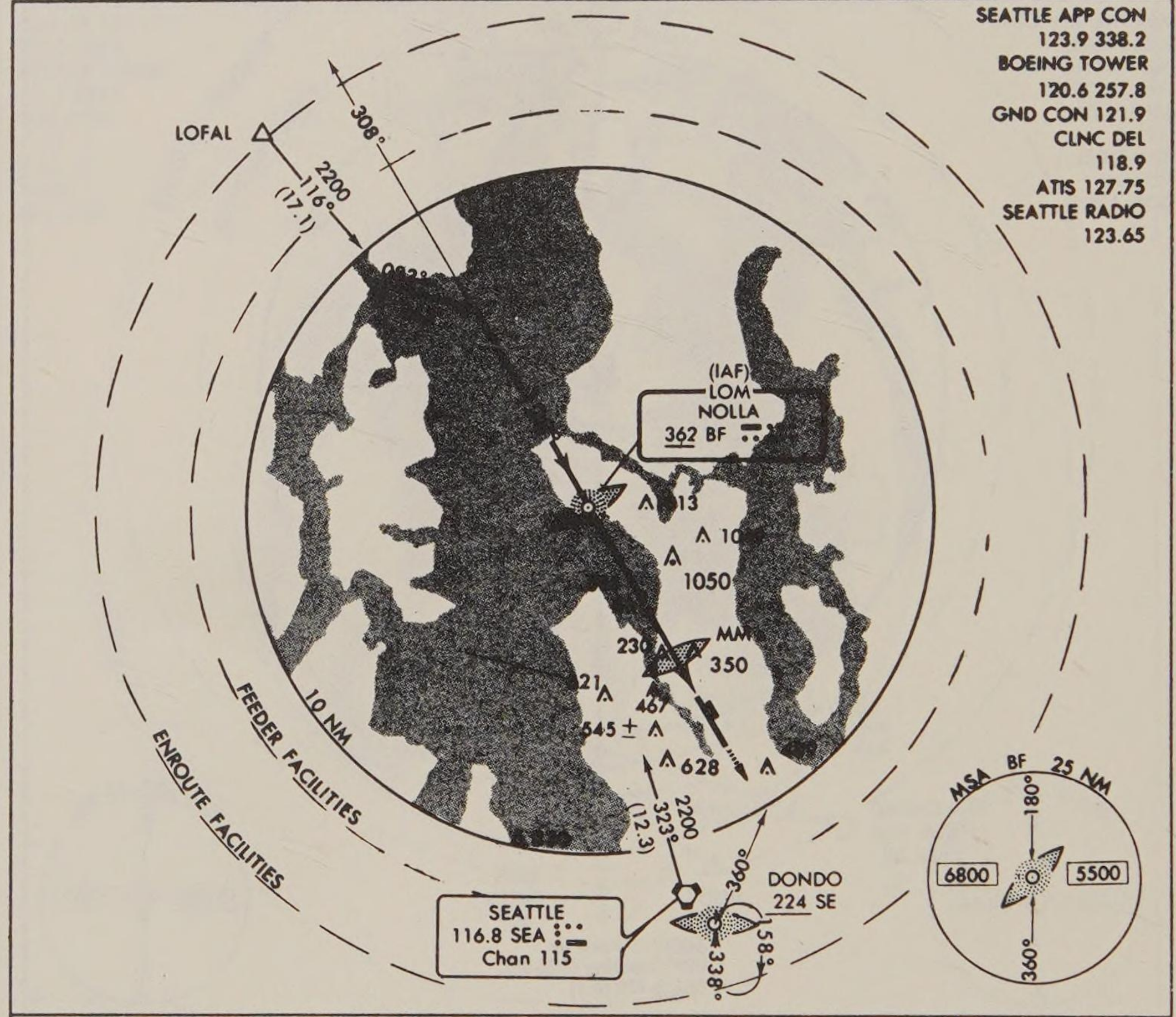
Not for use in Navigation

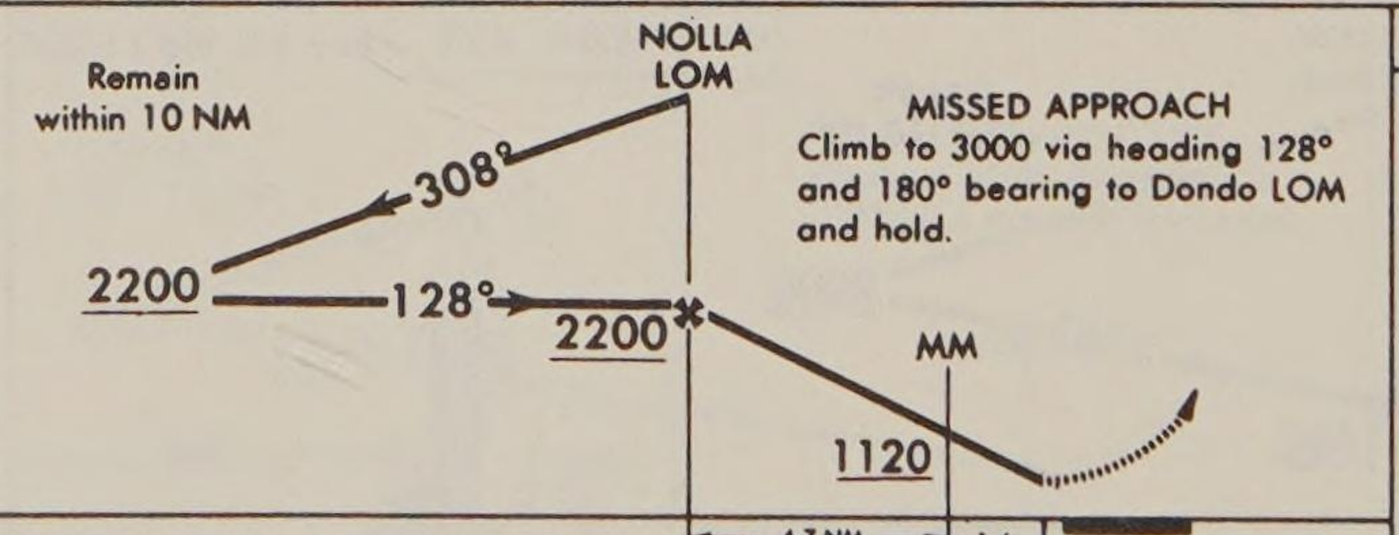
Amdt 7

NDB-A

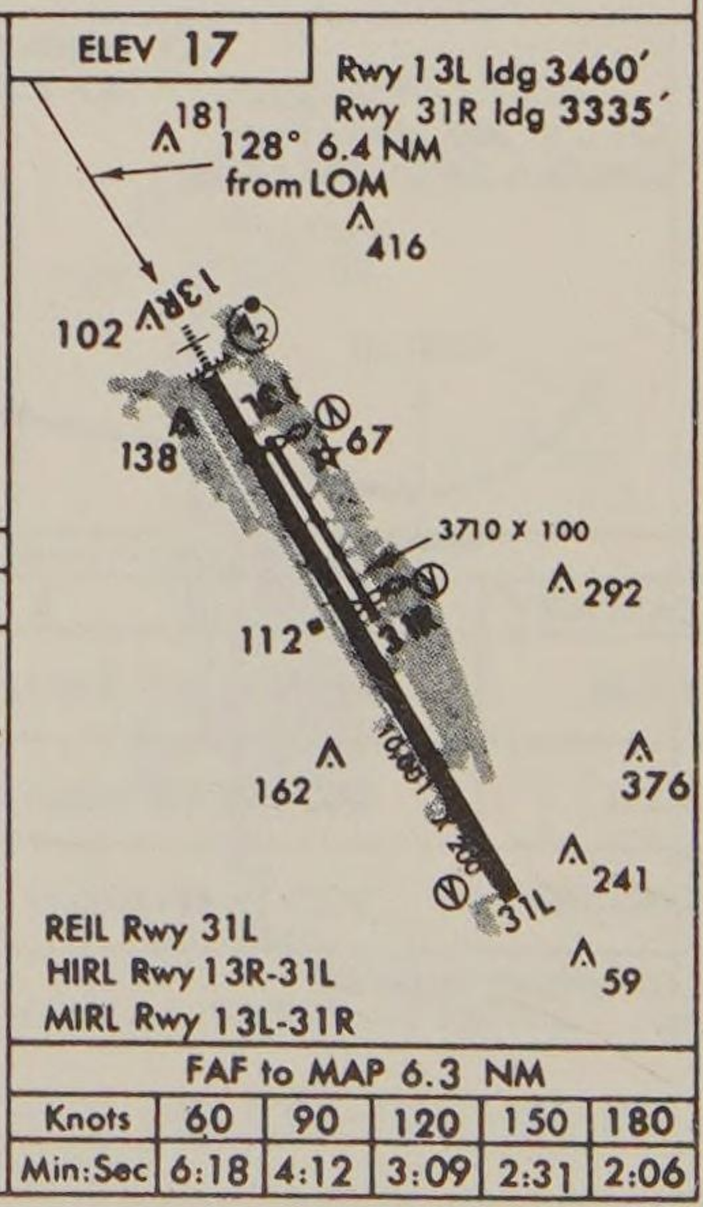
SEATTLE/BOEING FIELD/KING COUNTY INTL (BFI)
SEATTLE, WASHINGTON

SEATTLE APP CON
123.9 338.2
BOEING TOWER
120.6 257.8
GND CON 121.9
CLNC DEL
118.9
ATIS 127.75
SEATTLE RADIO
123.65





CATEGORY	A	B	C	D
CIRCLING	800-1 783 (800-1)	800-1¼ 783 (800-1¼)	820-2¼ 803 (900-2¼)	960-3 943 (1000-3)



FAF to MAP 6.3 NM					
Knots	60	90	120	150	180
Min:Sec	6:18	4:12	3:09	2:31	2:06

NDB-A

47°32'N-122°18'W

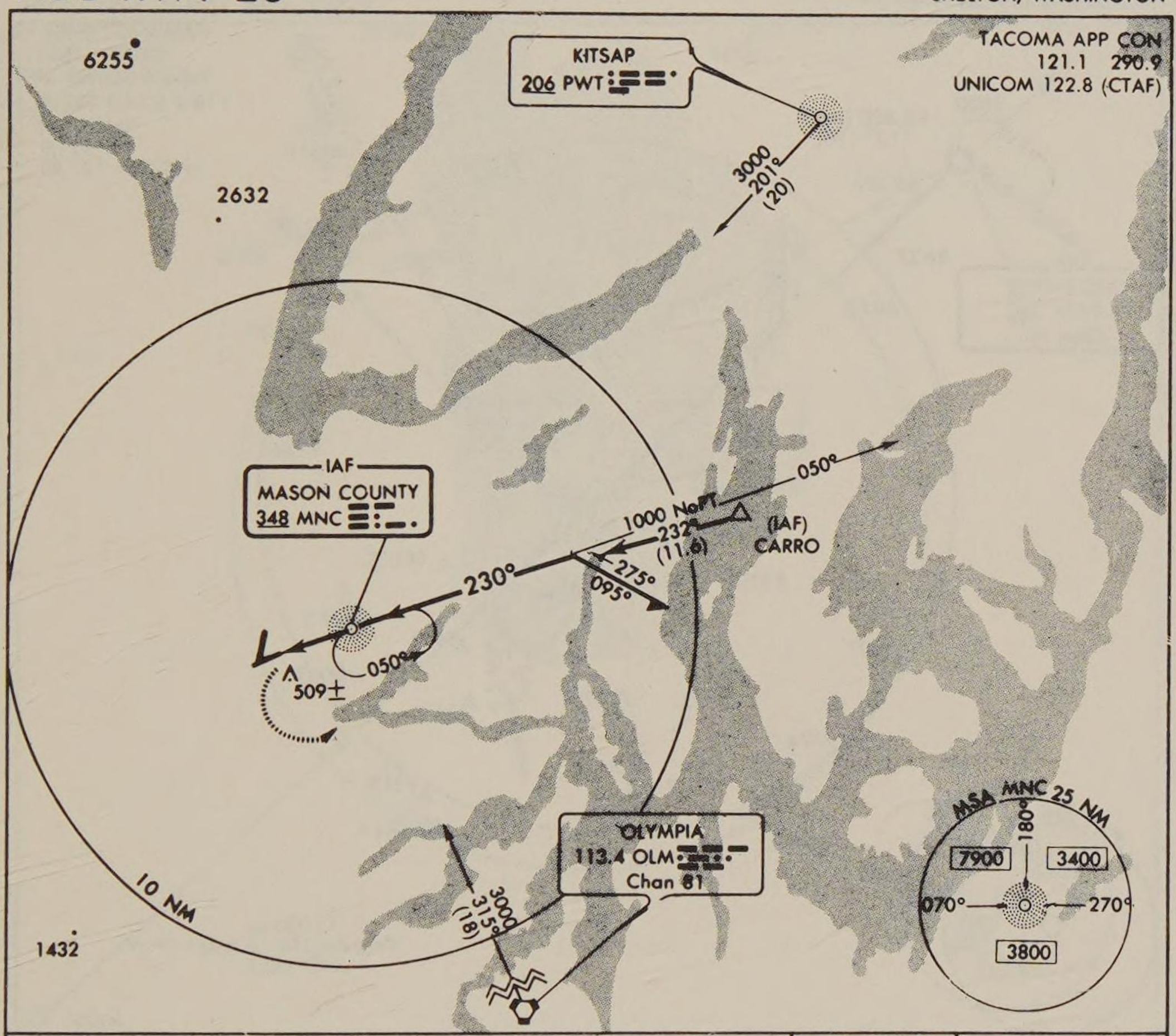
SEATTLE, WASHINGTON
SEATTLE/BOEING FIELD/KING COUNTY INTL (BFI)

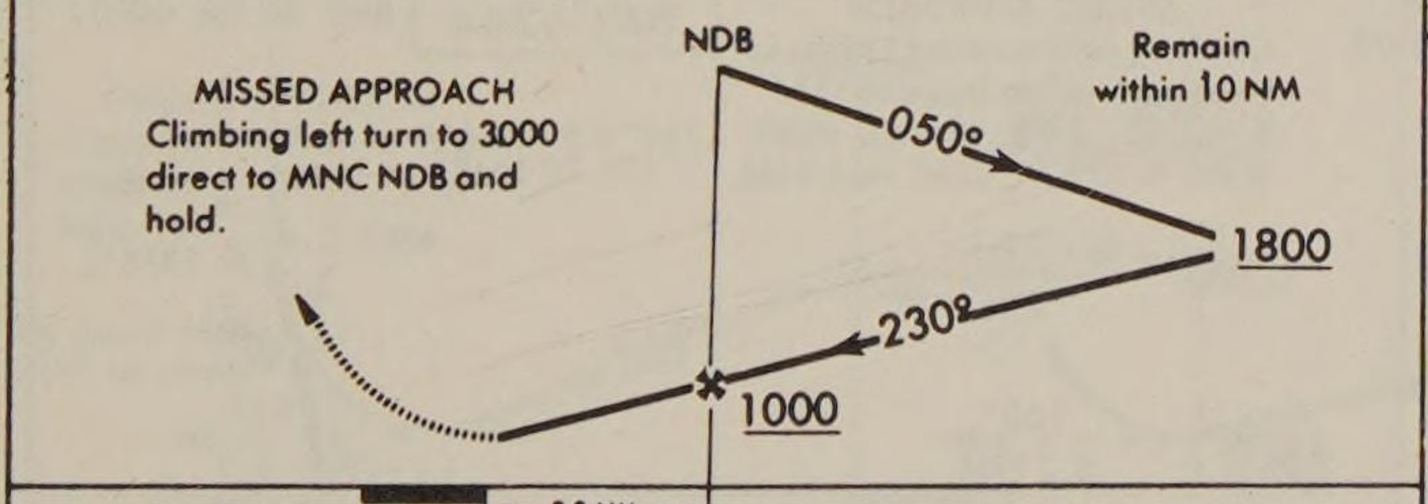
Not for use in Navigation

Orig

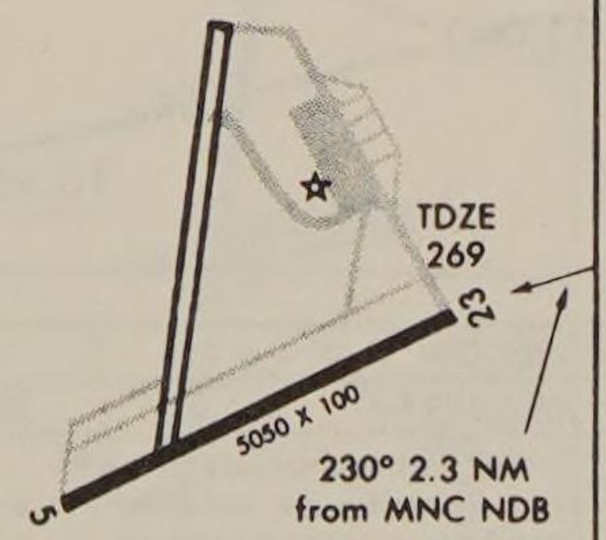
NDB RWY 23

SHELTON/SANDERSON FLD (SHN)
SHELTON, WASHINGTON





ELEV 278



MIRL Rwy 5-23

CATEGORY	A	B	C	D
S-23	880-1	611 (700-1)	880-1¾ 611 (700-1¾)	1000-2¼ 731 (800-2¼)
CIRCLING	960-1	682 (700-1)	1000-2 722 (800-2)	1080-2½ 802 (900-2½)

Use Olympia, WA altimeter setting.
(T)
(A) NA

FAF to MAP 2.3 NM

Knots	60	90	120	150	180
Min:Sec	2:18	1:32	1:09	0:55	0:46

NDB RWY 23

47°14'N-123°09'W

SHELTON, WASHINGTON
SHELTON/SANDERSON FLD (SHN)

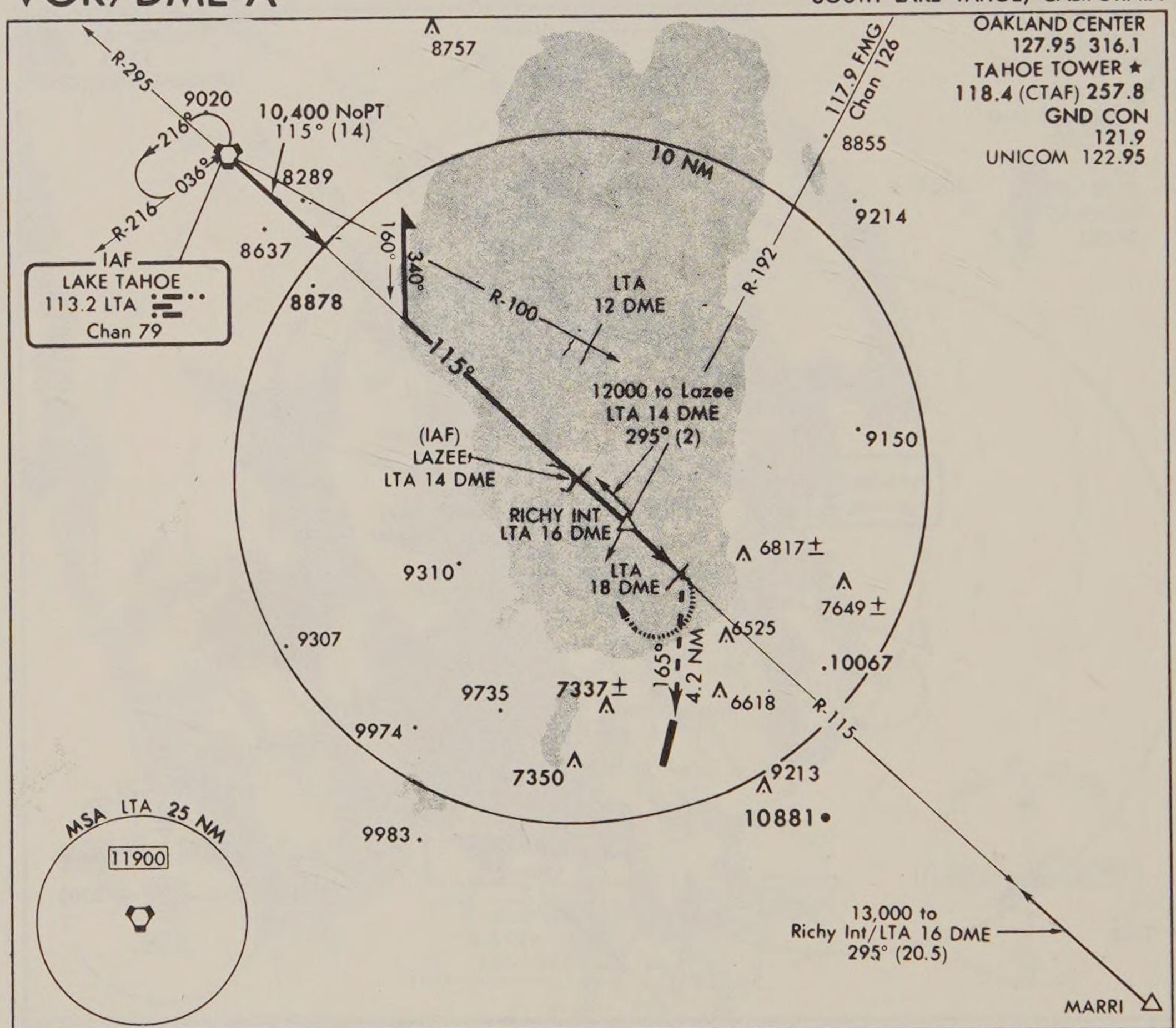
Not for use in Navigation

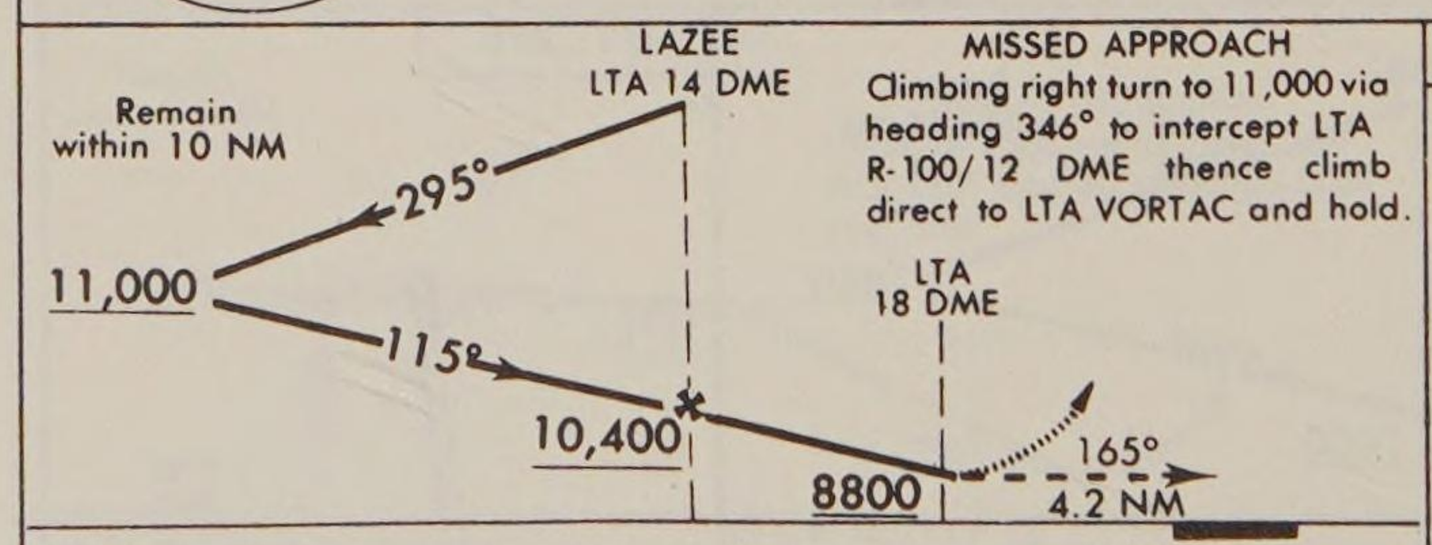
Amdt 2

VOR/DME-A

SOUTH LAKE TAHOE/LAKE TAHOE (TVL)
SOUTH LAKE TAHOE, CALIFORNIA

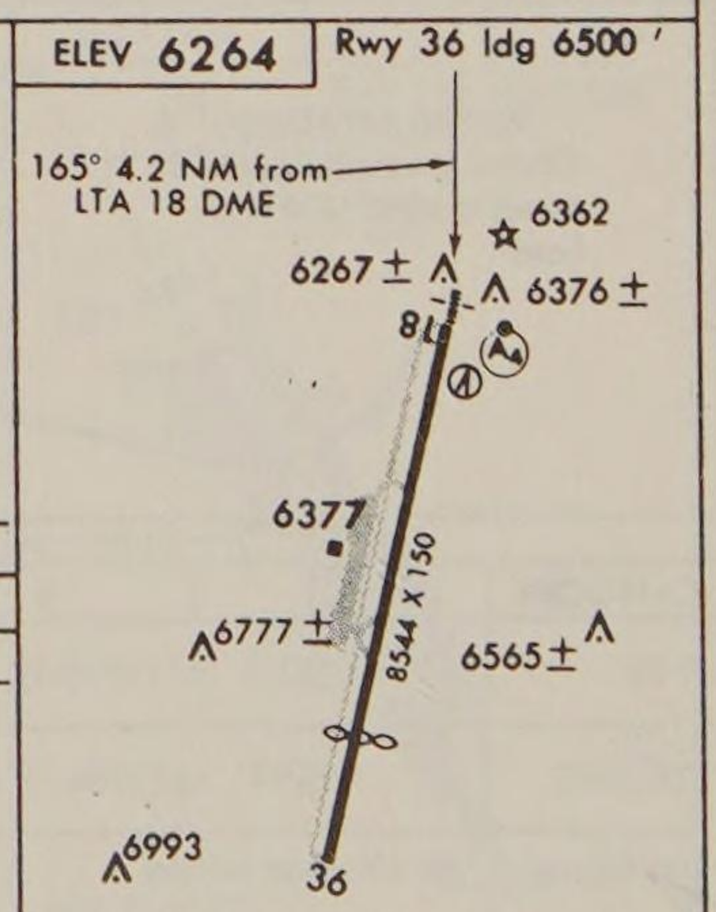
OAKLAND CENTER
127.95 316.1
TAHOE TOWER ★
118.4 (CTAF) 257.8
GND CON
121.9
UNICOM 122.95





CATEGORY	A	B	C	D
CIRCLING*	8800-5 2536 (2600-5)			

*Circling not authorized at night.
When control zone not in effect, except for operators with approved weather reporting service, procedure not authorized.
Air carrier reductions for local conditions not authorized.
Fly visual to airport 165°-4.2 NM.



Knots	60	90	120	150	180
Min:Sec					

VOR/DME-A

38°54′N-120°00′W

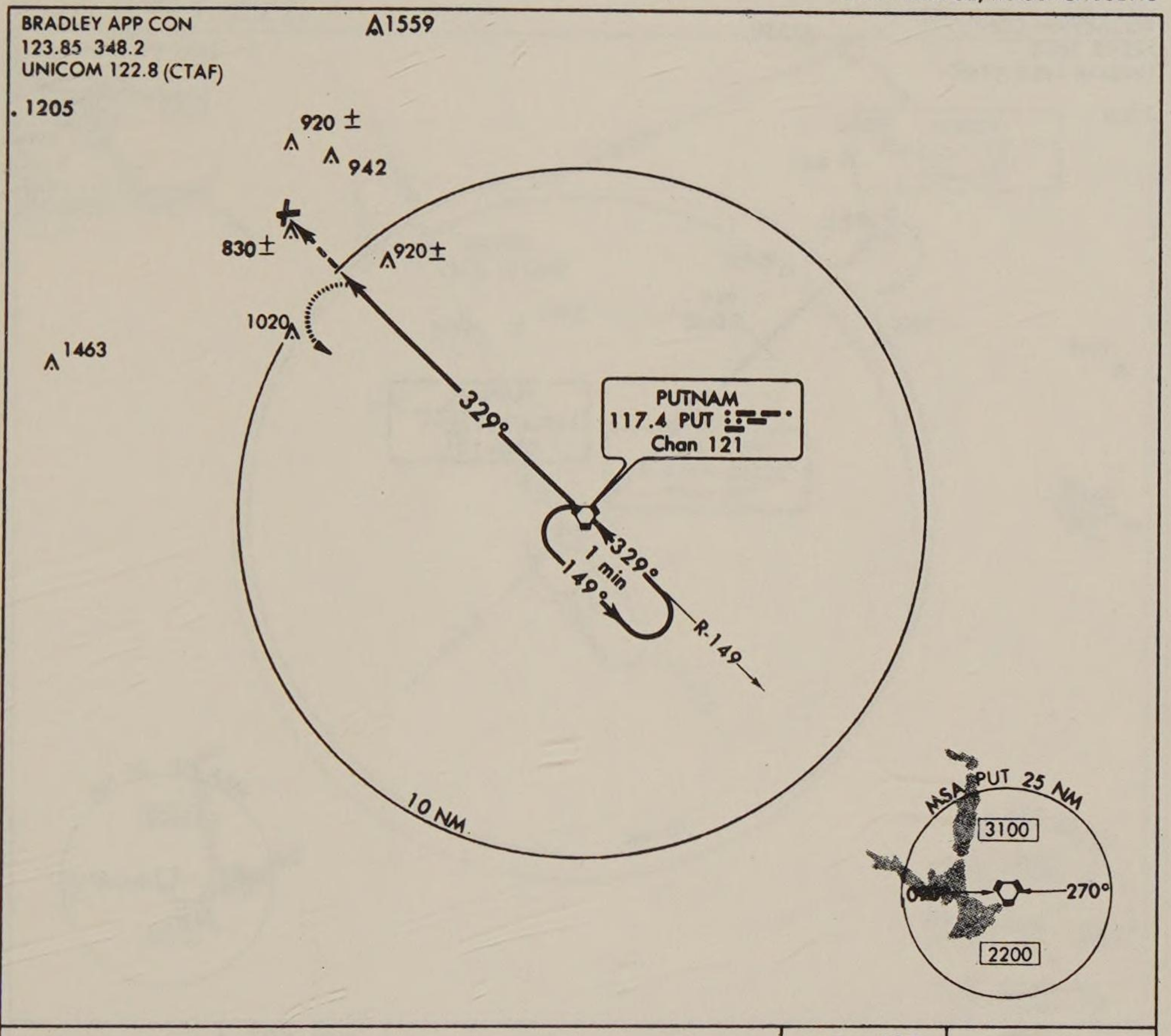
SOUTH LAKE TAHOE, CALIFORNIA
SOUTH LAKE TAHOE/LAKE TAHOE (TVL)

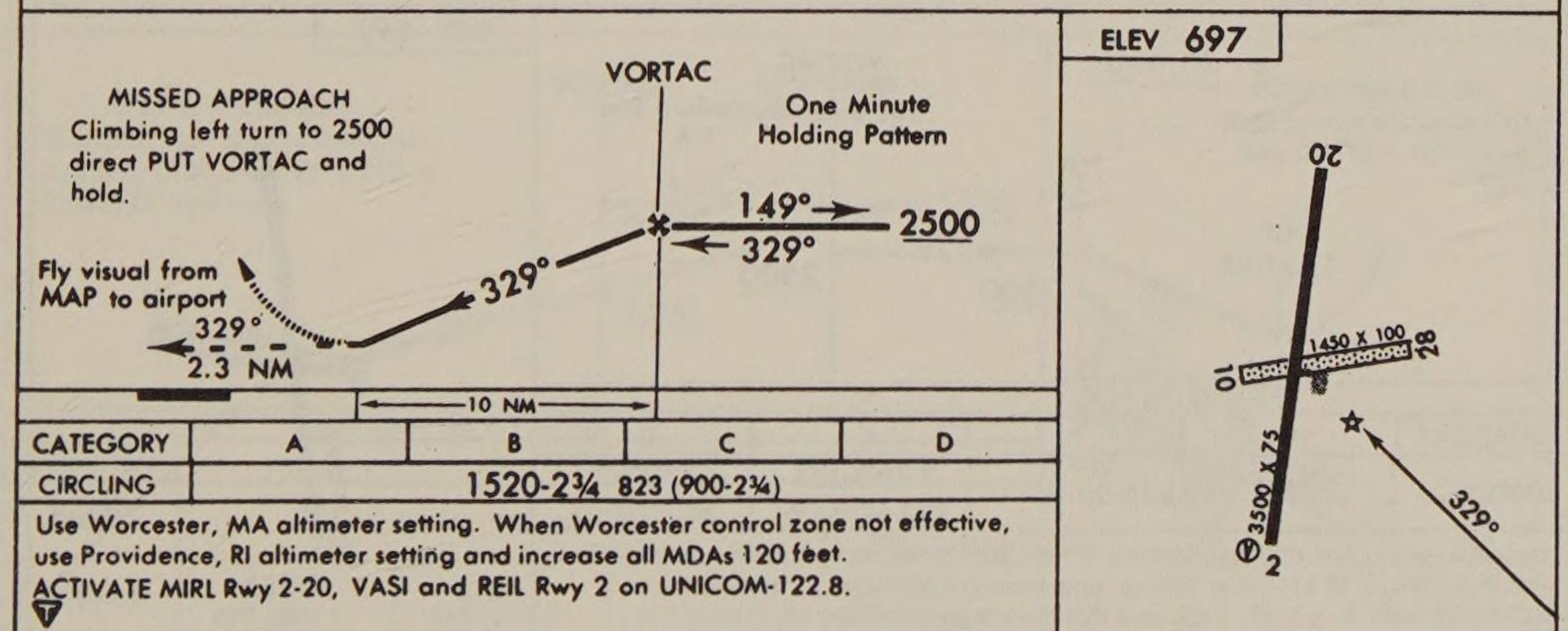
Not for use in Navigation

Amdt 2

VOR-A

SOUTHBRIDGE MUNI (3B Ø)
SOUTHBRIDGE, MASSACHUSETTS





CATEGORY	A	B	C	D
CIRCLING	1520-2¾ 823 (900-2¾)			

Use Worcester, MA altimeter setting. When Worcester control zone not effective, use Providence, RI altimeter setting and increase all MDAs 120 feet.
ACTIVATE MIRL Rwy 2-20, VASI and REIL Rwy 2 on UNICOM-122.8.

NA

ELEV 697

REIL Rwy 2
MIRL Rwy 2-20

FAF to MAP 10 NM					
Knots	60	90	120	150	180
Min:Sec	10:00	6:40	5:00	4:00	3:20

VOR-A

42°06'N – 72°02'W

SOUTHBRIDGE, MASSACHUSETTS
SOUTHBRIDGE MUNI (3B Ø)

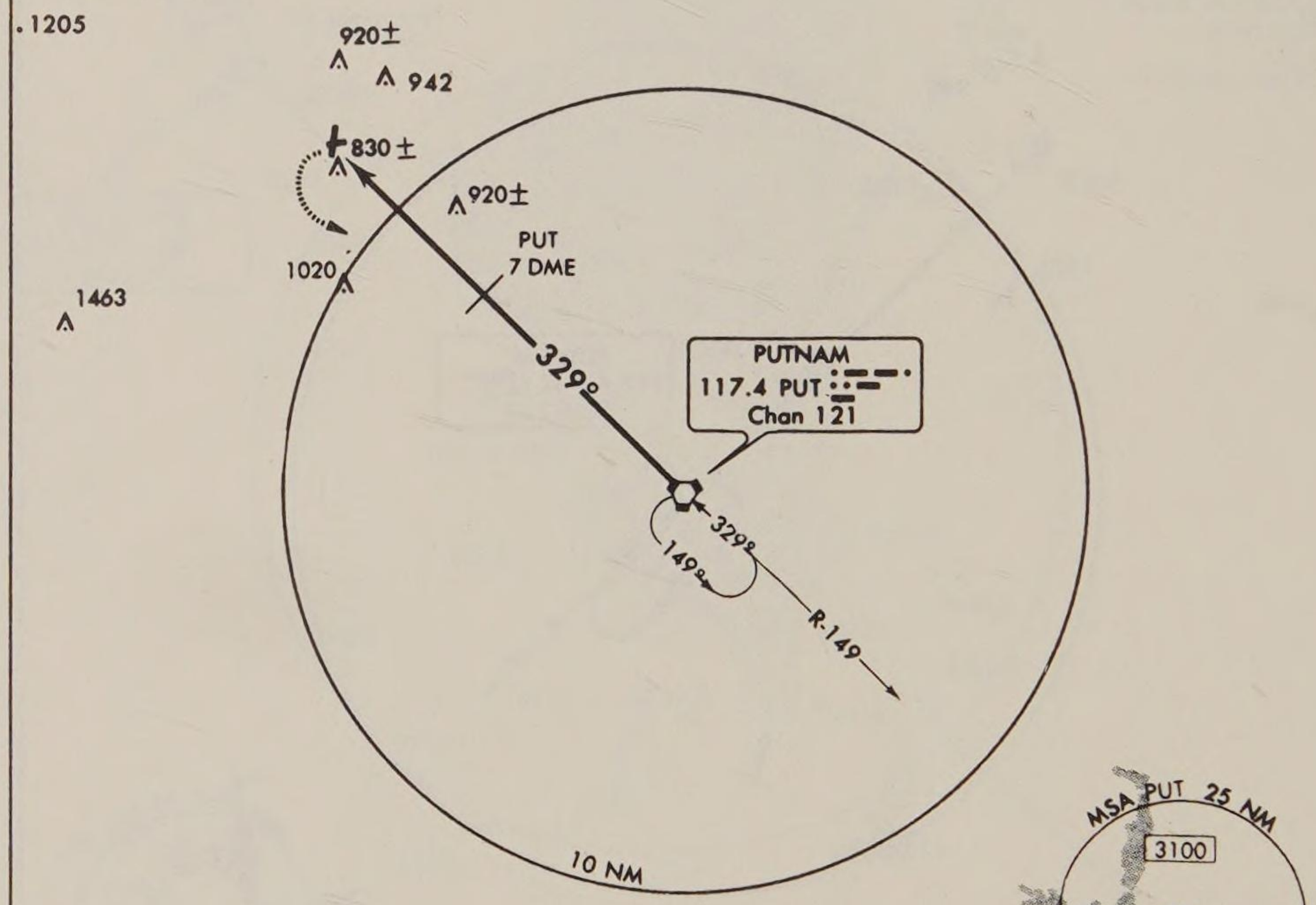
Not for use in Navigation

Amdt 5

VOR/DME-B

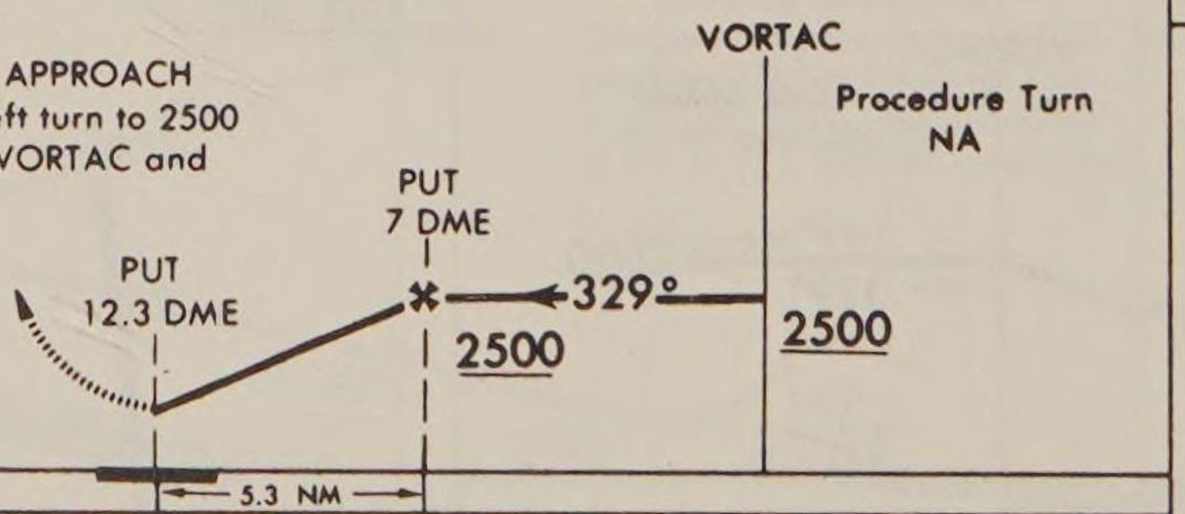
SOUTHBRIDGE MUNI (3BØ)
SOUTHBRIDGE, MASSACHUSETTS

BRADLEY APP CON
123.85 348.3
UNICOM 122.8 (CTAF)



ELEV 697

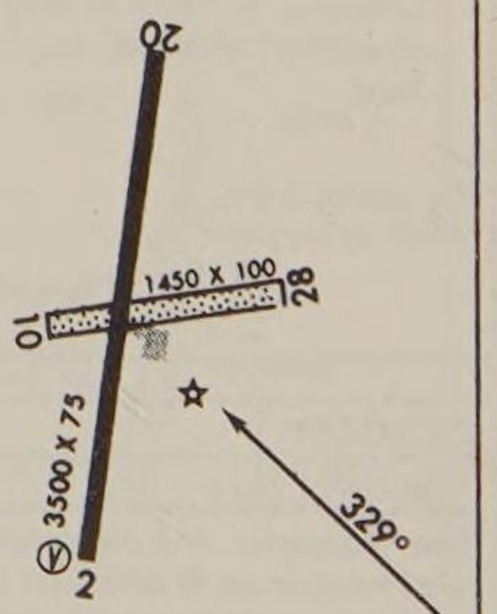
MISSED APPROACH
Climbing left turn to 2500 direct PUT VORTAC and hold.



CATEGORY	A	B	C	D
CIRCLING	1280-1 583(600-1)		1280-1½ 583 (600-1½)	1300-2 603 (700-2)

Use Worcester, MA altimeter setting. When Worcester control zone not effective, use Providence, RI altimeter setting and increase all MDAs 120 feet.
ACTIVATE MIRL Rwy 2-20, VASI and REIL Rwy 2 on UNICOM-122.8.

NA



REIL Rwy 2
MIRL Rwy 2-20

Knots	60	90	120	150	180
Min:Sec					

VOR/DME-B

42°06'N-72°02'W

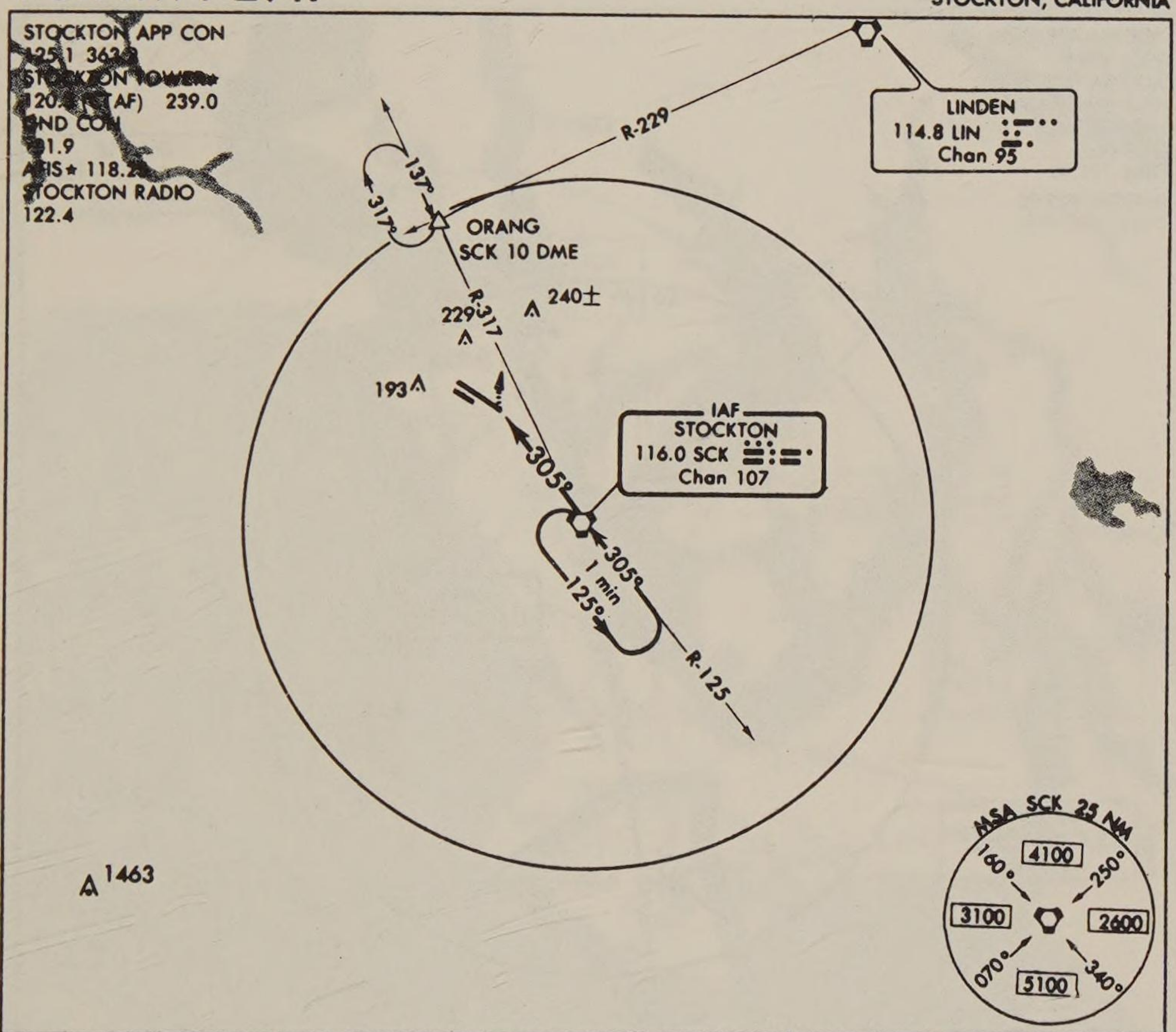
SOUTHBRIDGE, MASSACHUSETTS
SOUTHBRIDGE MUNI (3BØ)

Not for use in Navigation

Amdt 16

VOR RWY 29R

STOCKTON METROPOLITAN (SCK)
STOCKTON, CALIFORNIA



CATEGORY	A	B	C	D
S-29R	340-½ 310 (400-½)			340-1 310 (400-1)
CIRCLING	500-1 470 (500-1)	540-1 510 (600-1)	540-1½ 510 (600-1½)	580-2 550 (600-2)

Cat D S-29 inoperative table does not apply.

FAF to MAP 4 NM

Knots	60	90	120	150	180
Min:Sec	4:00	2:40	2:00	1:36	1:20

VOR RWY 29R

37°54'N-121°15'W

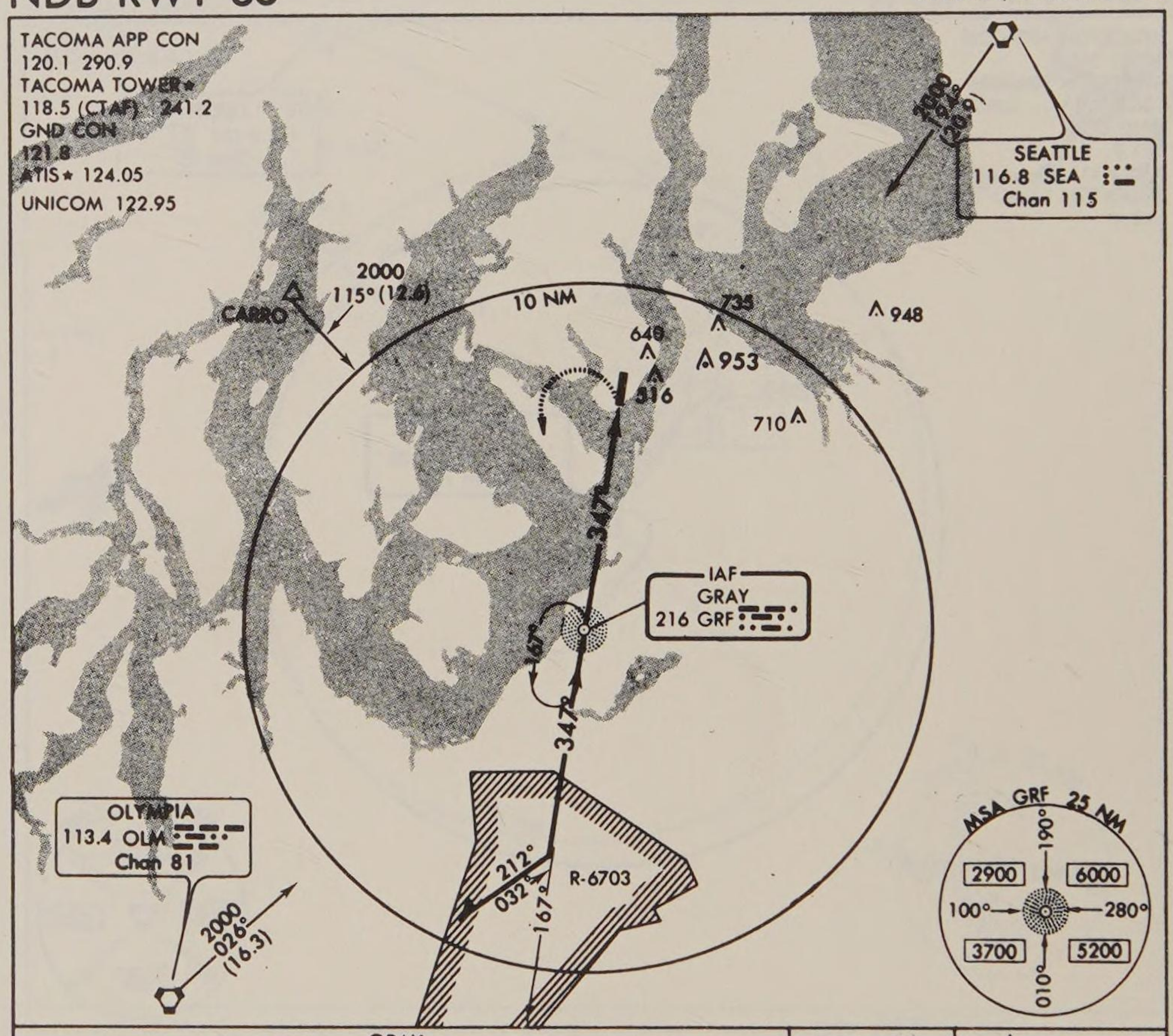
STOCKTON, CALIFORNIA
STOCKTON METROPOLITAN (SCK)

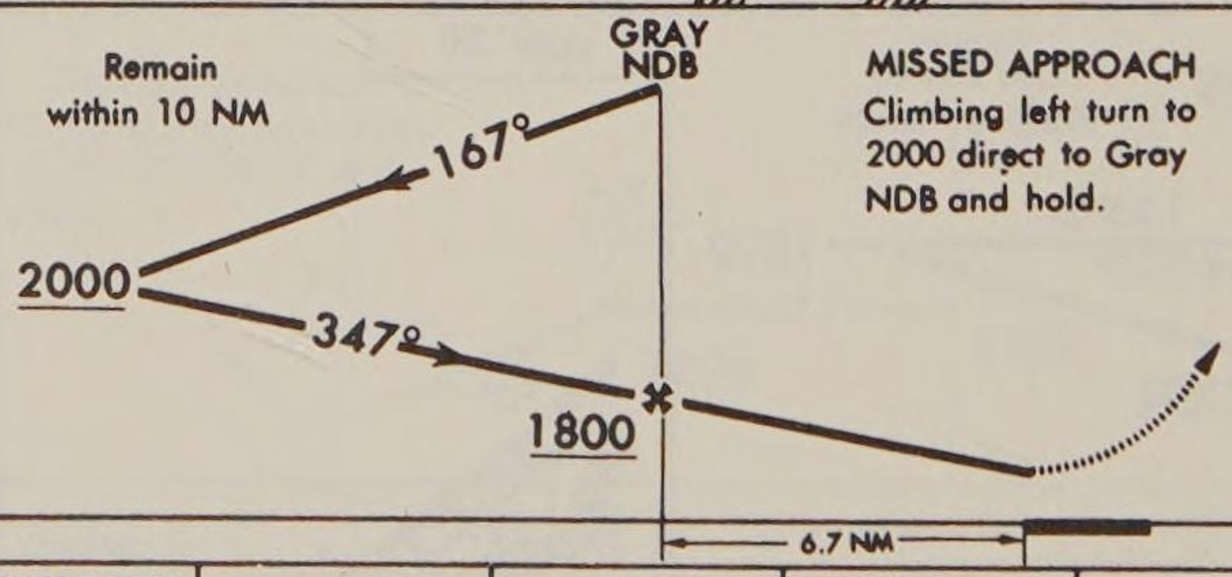
Not for use in Navigation

Amdt 3

NDB RWY 35

TACOMA NARROWS (TIW)
TACOMA, WASHINGTON

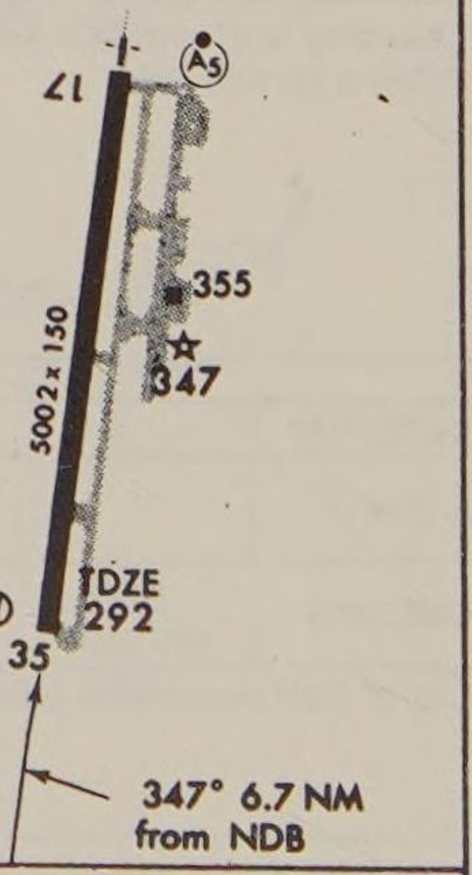




ELEV 292

326

MIRL Rwy 17-35
REIL Rwy 35



CATEGORY	A	B	C	D
S-35	880-1 588 (600-1)		880-1½ 588 (600-1½)	880-1¾ 588 (600-1¾)
CIRCLING	880-1 588 (600-1)		880-1½ 588(600-1½)	880-2 588 (600-2)

When control zone not in effect, the following applies: 1. Use Mc Chord AFB altimeter setting. 2. All MDA s increased 20 feet. 3. Alternate minimums not authorized. Circling not authorized east of runway 17-35.

FAF to MAP 6.7 NM					
Knots	60	90	120	150	180
Min:Sec	6:42	4:28	3:21	2:41	2:14

NDB RWY 35

47°16'N-122°35'W

TACOMA, WASHINGTON
TACOMA NARROWS (TIW)

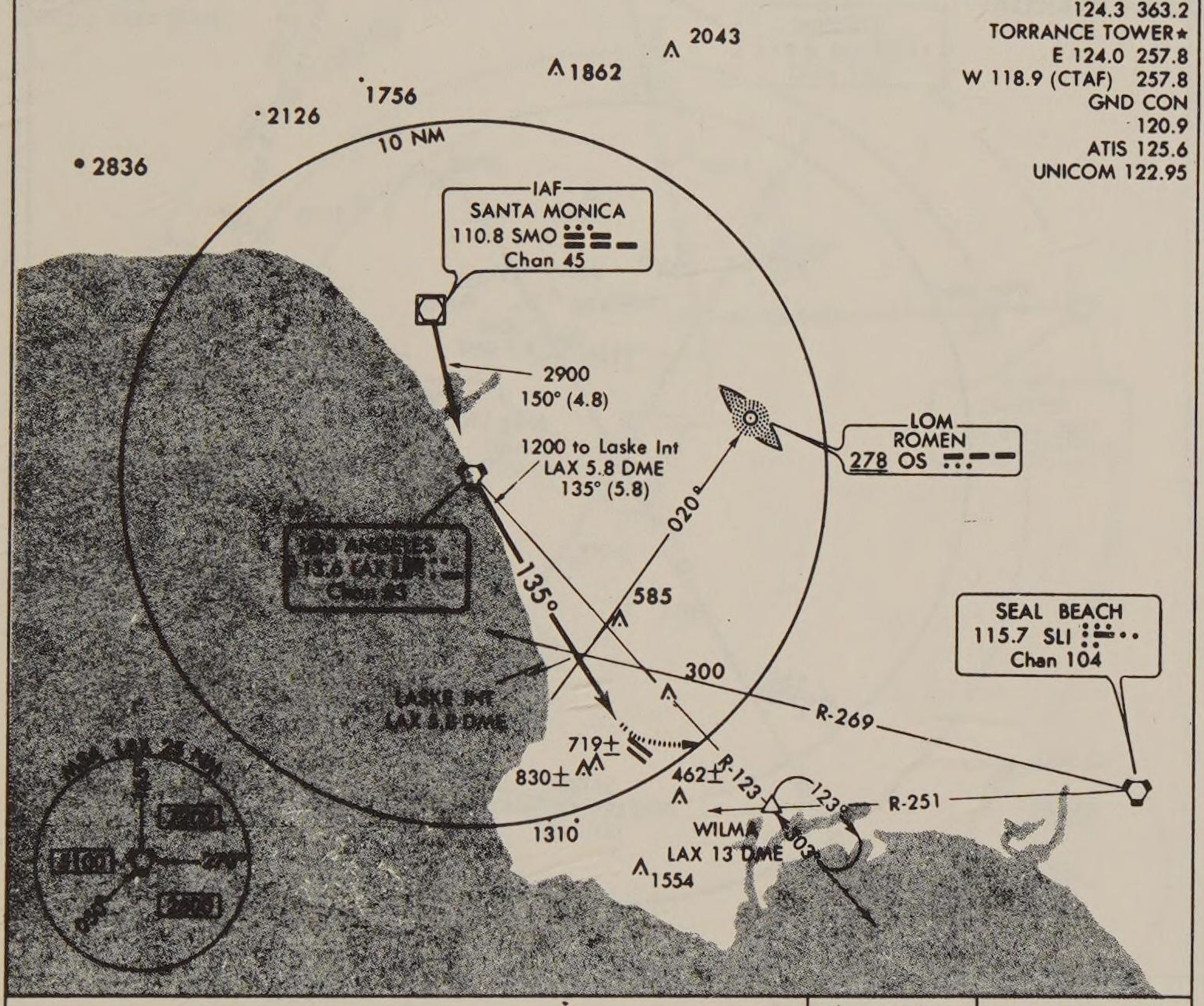
Not for use in Navigation

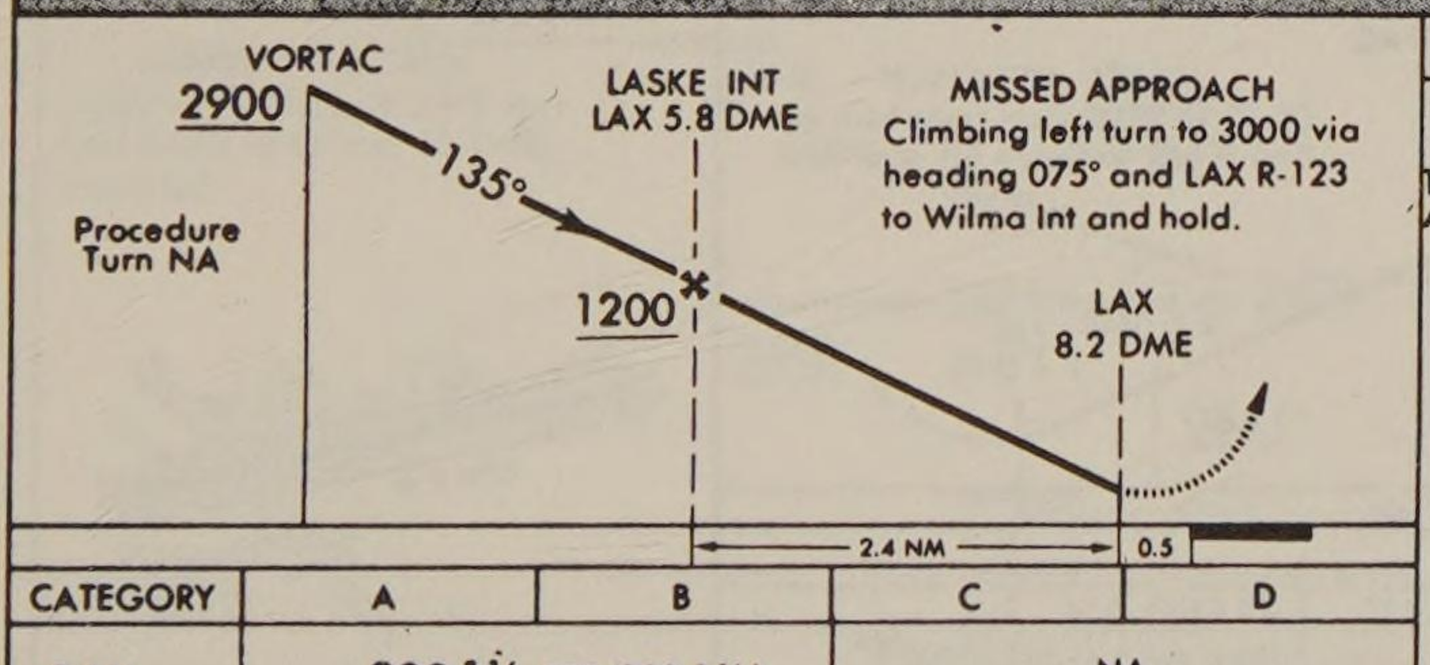
Amdt 13

VOR RWY 11L

TORRANCE MUNI (TOA)
TORRANCE, CALIFORNIA

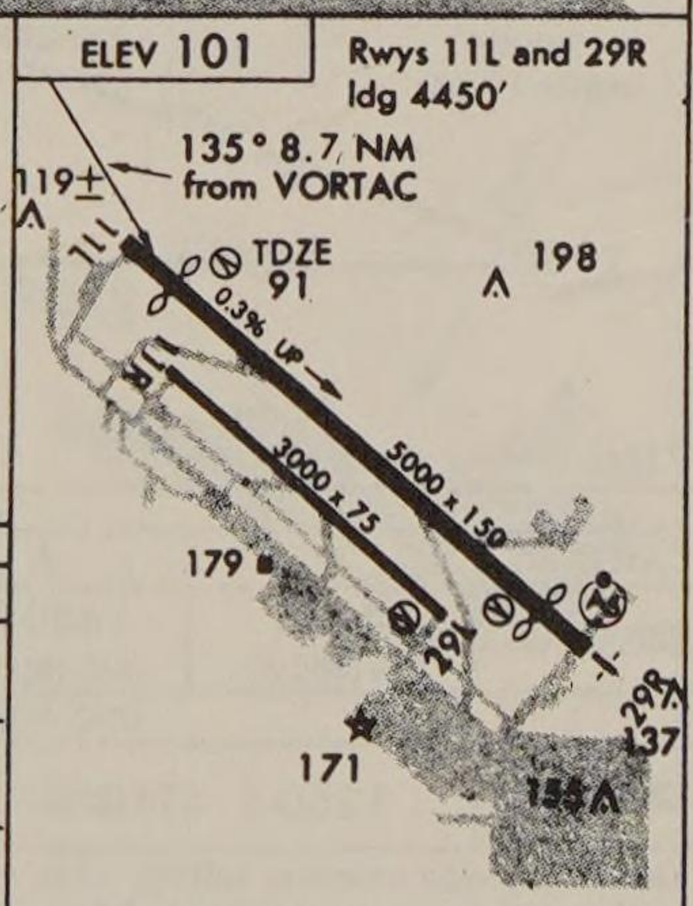
LOS ANGELES APP CON
124.3 363.2
TORRANCE TOWER★
E 124.0 257.8
W 118.9 (CTAF) 257.8
GND CON
120.9
ATIS 125.6
UNICOM 122.95





CATEGORY	A	B	C	D
S-11L	980-1¼ 889 (900-1¼)		NA	
CIRCLING	980-1¼ 879 (900-1¼)		NA	

When control zone not in effect, except for operators with approved weather reporting service: 1. Use Los Angeles altimeter setting. 2. Increase all MDAs 20 feet. 3. Alternate minimums not authorized.
Circling not authorized Southwest of Rwy 11R-29L



REIL Rwy 29L
MIRL Rwys 11L-29R and 11R-29L

FAF to MAP 2.4 NM					
Knots	60	90	120	150	180
Min:Sec	2:24	1:36	1:12	0:58	0:48

VOR RWY 11L

33°48'N-118°20'W

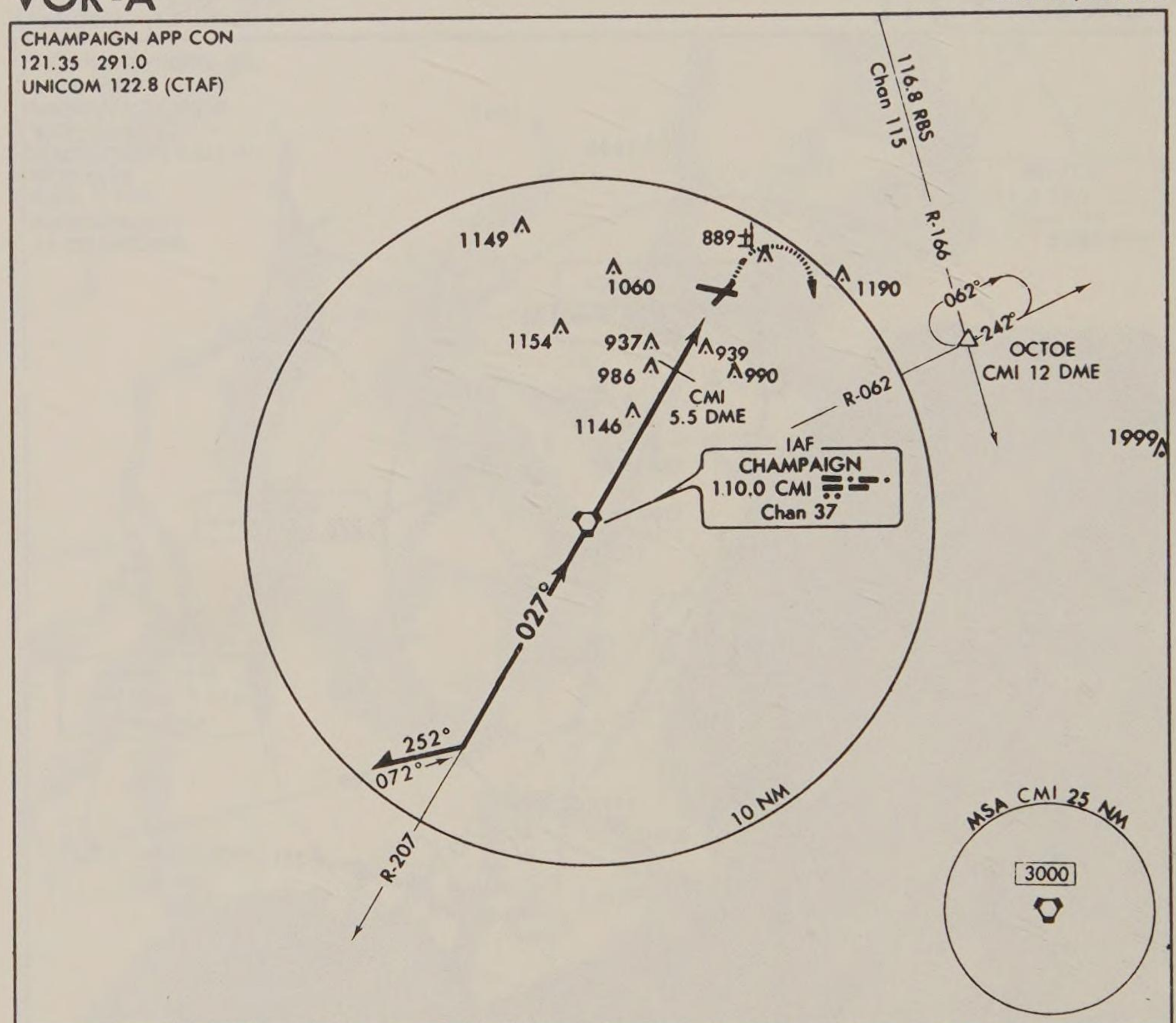
TORRANCE, CALIFORNIA
TORRANCE MUNI (TOA)

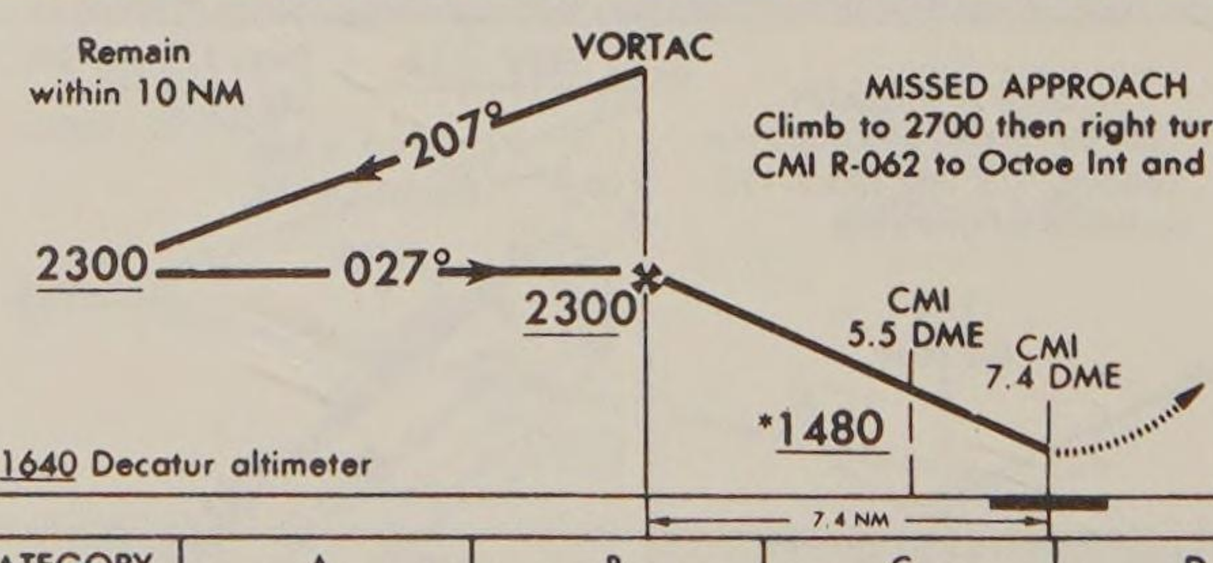
Not for use in Navigation

Amdt 10

VOR-A

URBANA/FRASCA FLD (C16)
URBANA, ILLINOIS

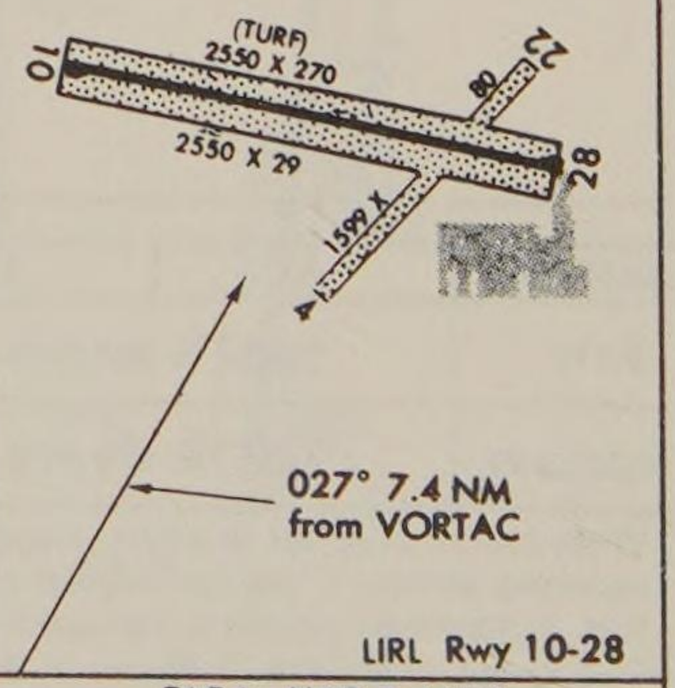




CATEGORY	A	B	C	D
CIRCLING	1480-1 745 (800-1)	1480-1¼ 745 (800-1¼)	1480-2¼ 745 (800-2¼)	NA
DME MINIMA				
CIRCLING	1260-1 525 (600-1)		1260-1½ 525 (600-1½)	NA

Use Champaign altimeter setting; when not available, use Decatur altimeter setting and increase all MDAs 160 feet.
⚠NA

ELEV 735



FAF to MAP 7.4 NM					
Knots	60	90	120	150	180
Min:Sec	7:24	4:56	3:42	2:58	2:28

VOR-A

40°09'N-88°12'W

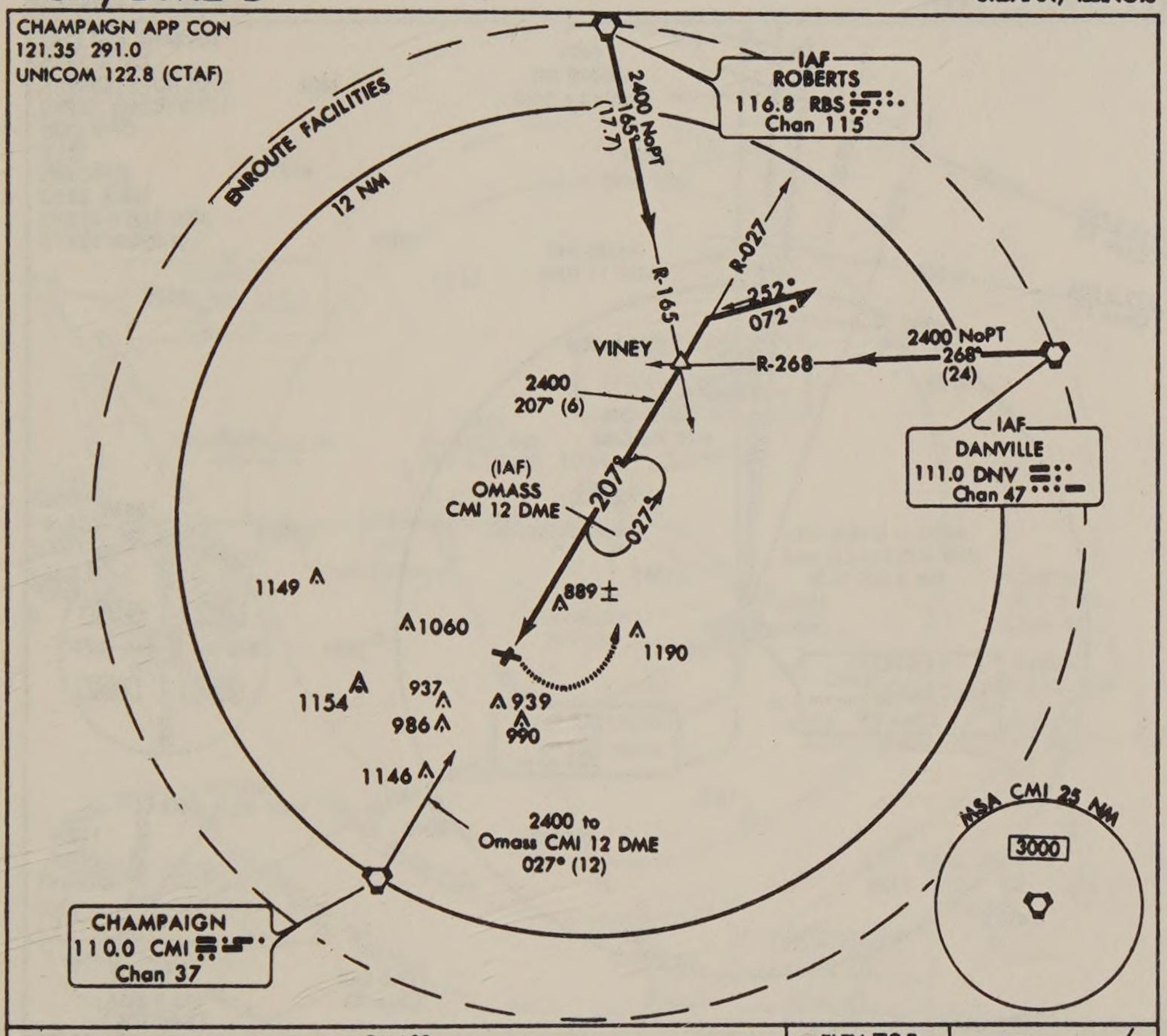
URBANA, ILLINOIS
URBANA/FRASCA FLD (C16)

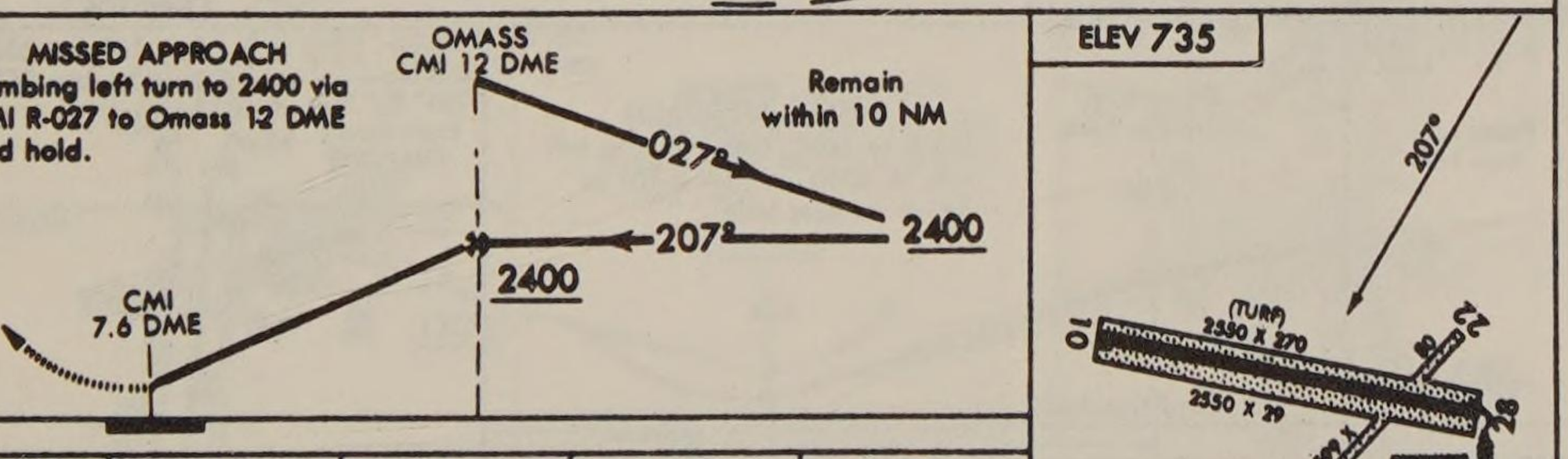
Not for use in Navigation

Amdt 5

VOR/DME-B

URBANA/FRASCA FLD (C16)
URBANA, ILLINOIS





CATEGORY	A	B	C	D
CIRCLING	1260-1 525 (600-1)		1260-1½ 525 (600-1½)	NA
DECATUR ALTIMETER SETTING MINIMUMS				
CIRCLING	1400-1 665 (700-1)		1400-1½ 665 (700-1½)	NA

Use Champaign altimeter setting; when not available use Decatur altimeter setting
⚠NA

LIRL Rwy 10-28

Knots	60	90	120	150	180
Min:Sec					

VOR/DME-B

40°09'N – 88°12'W

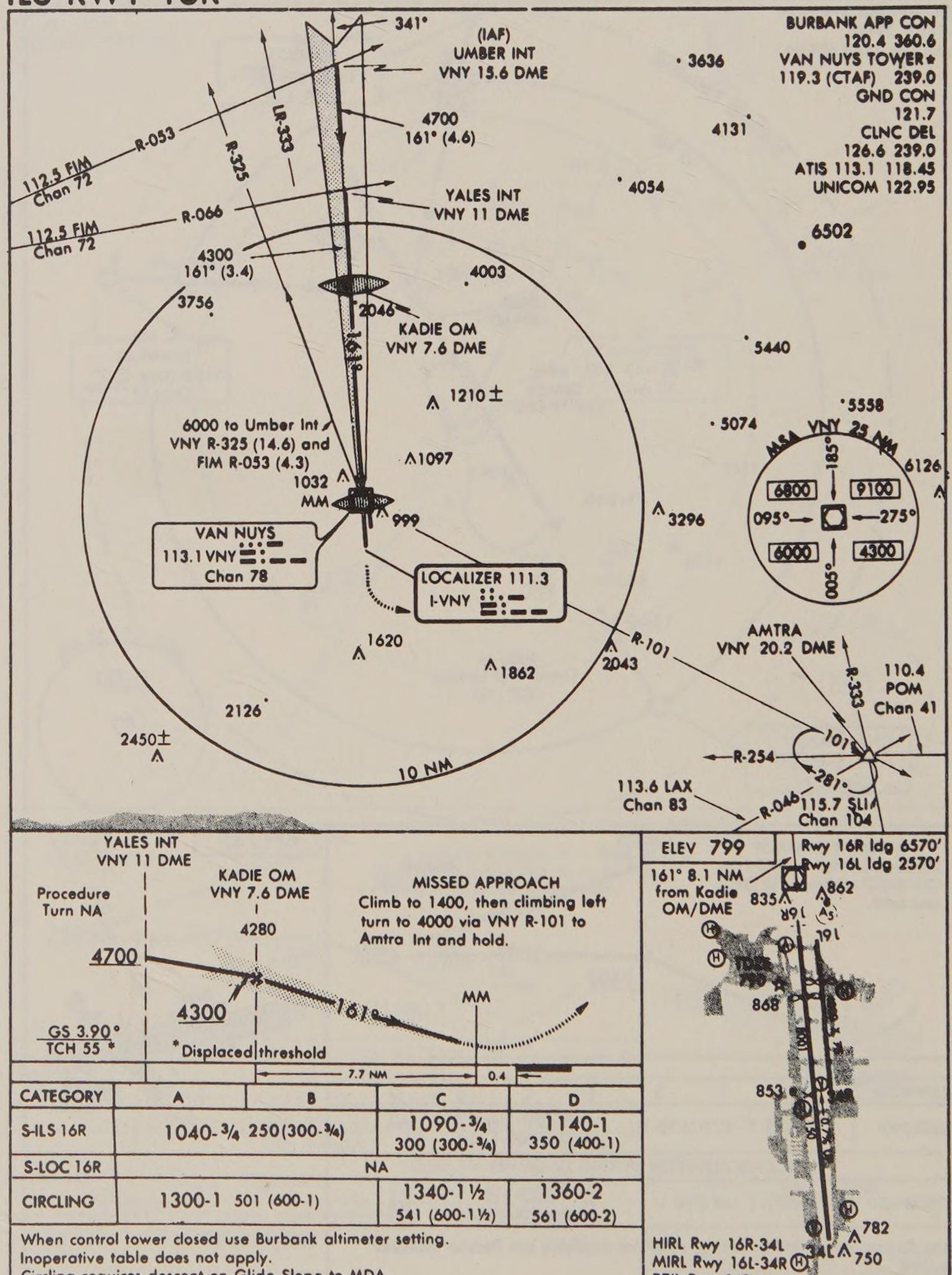
URBANA, ILLINOIS
URBANA/FRASCA FLD (C16)

Not for use in Navigation

Amdt 3

ILS RWY 16R

VAN NUYS (VNY)
VAN NUYS, CALIFORNIA



MISSED APPROACH
Climb to 1400, then climbing left turn to 4000 via VNY R-101 to Amtra Int and hold.

CATEGORY	A	B	C	D
S-ILS 16R	1040-¾ 250(300-¾)		1090-¾ 300 (300-¾)	1140-1 350 (400-1)
S-LOC 16R	NA			
CIRCLING	1300-1 501 (600-1)		1340-1½ 541 (600-1½)	1360-2 561 (600-2)

When control tower closed use Burbank altimeter setting.
Inoperative table does not apply.
Circling requires descent on Glide Slope to MDA.

FAF to MAP 8.1 NM

Knots	60	90	120	150	180
Min:Sec	8:06	5:24	4:03	3:14	2:42

ILS RWY 16R

34°13'N – 118°29'W

VAN NUYS, CALIFORNIA
VAN NUYS (VNY)

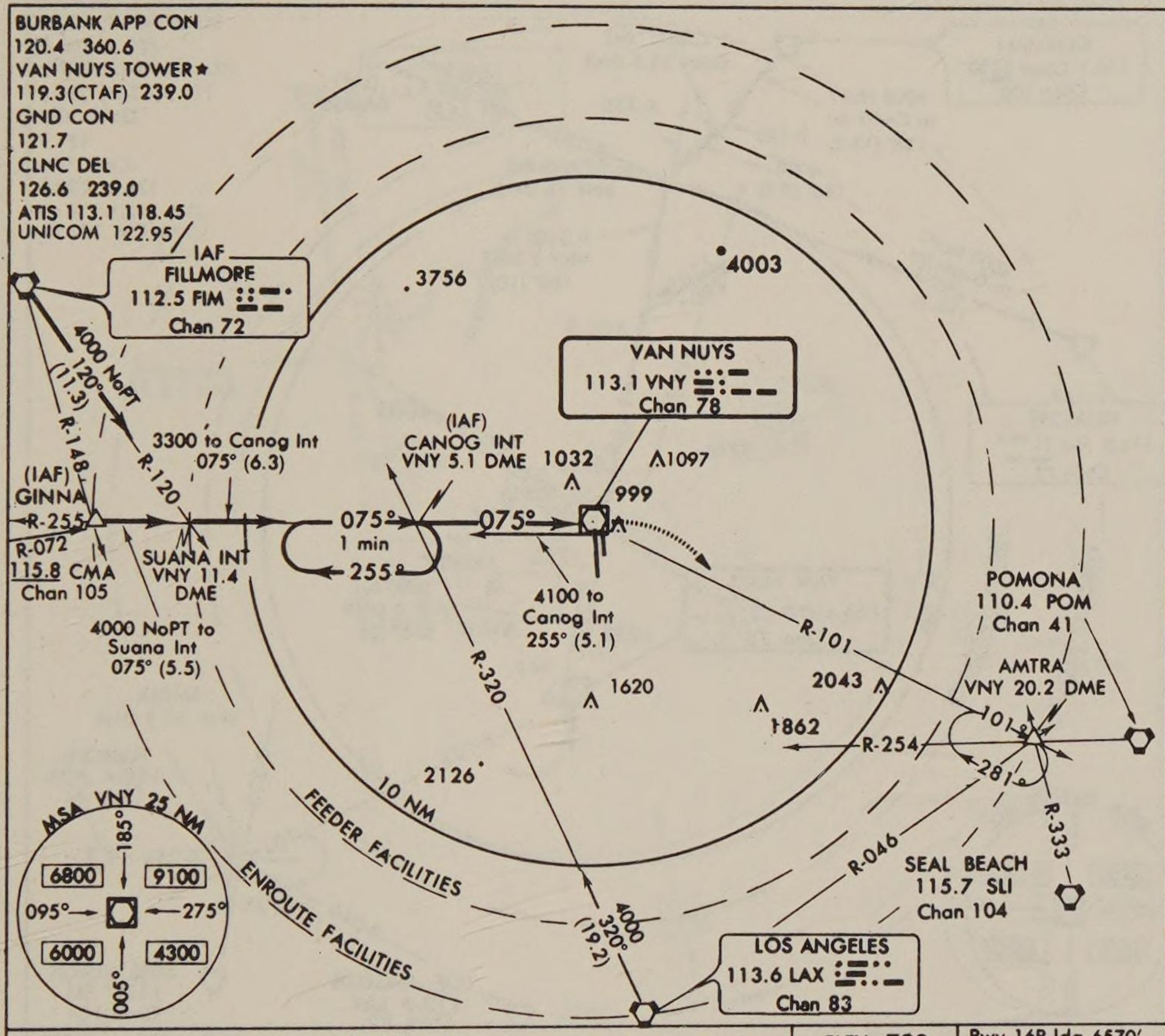
Not for use in Navigation

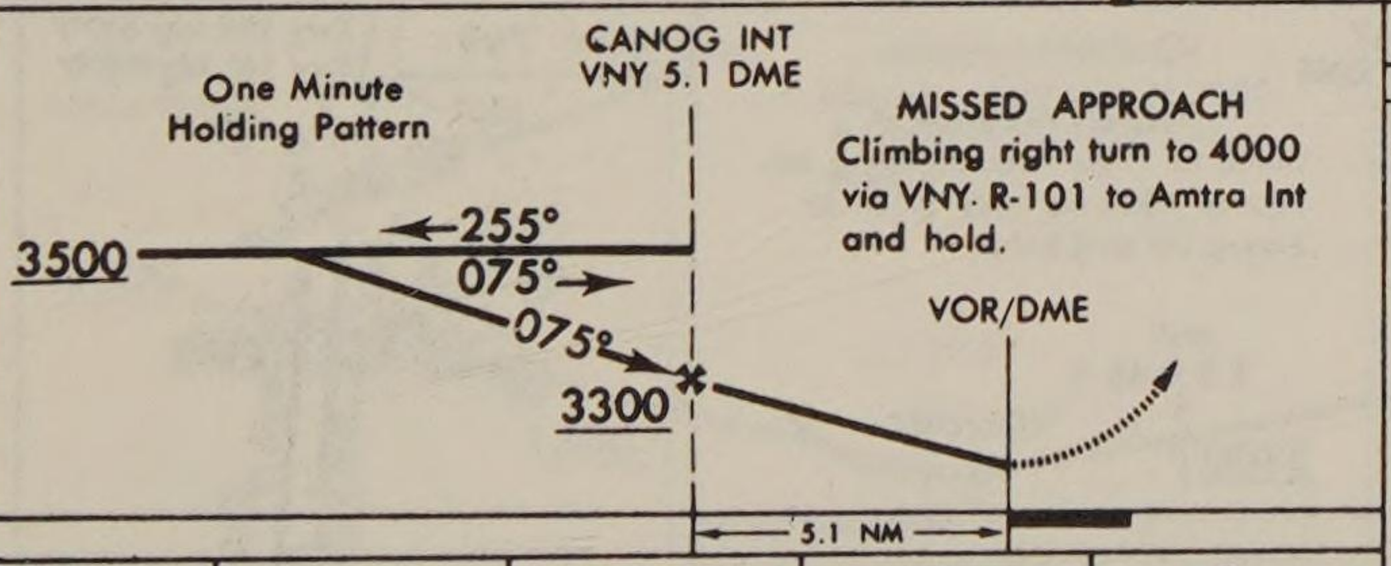
Amdt 1

VOR-A

VAN NUYS (VNY)
VAN NUYS, CALIFORNIA

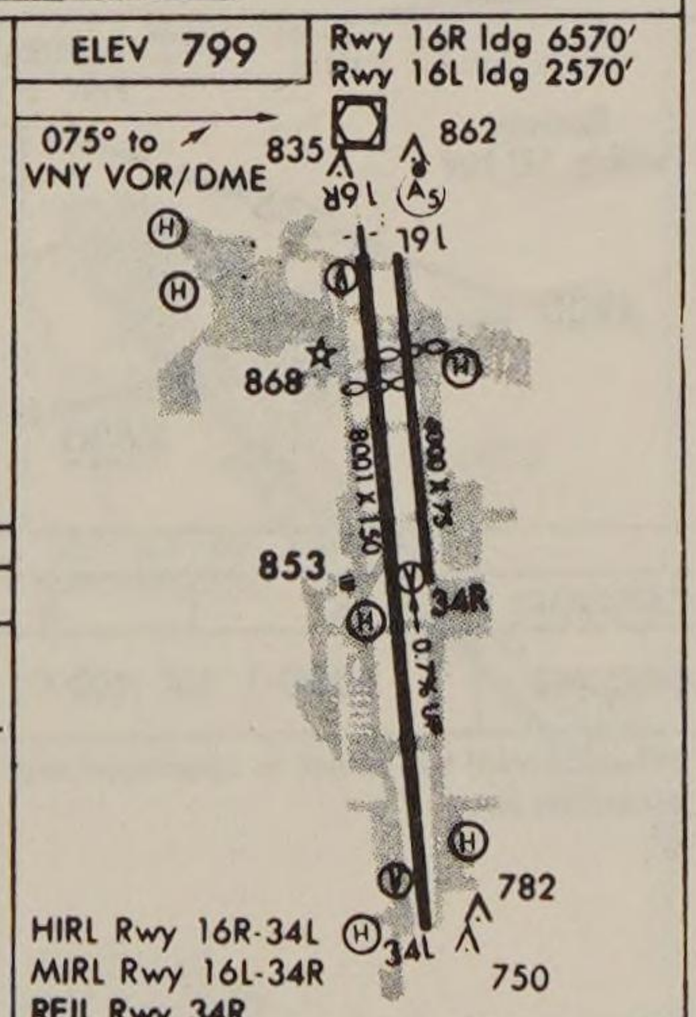
BURBANK APP CON
120.4 360.6
VAN NUYS TOWER★
119.3(CTAF) 239.0
GND CON
121.7
CLNC DEL
126.6 239.0
ATIS 113.1 118.45
UNICOM 122.95





CATEGORY	A	B	C	D
CIRCLING	1400-1 601 (700-1)		1400-1¾ 601 (700-1¾)	1400-2 601 (700-2)

When control tower not in operation use Burbank altimeter setting and alternate minimums NA.



Knots	60	90	120	150	180
Min:Sec					

VOR-A

34° 13′N-118° 29′W

VAN NUYS, CALIFORNIA
VAN NUYS (VNY)

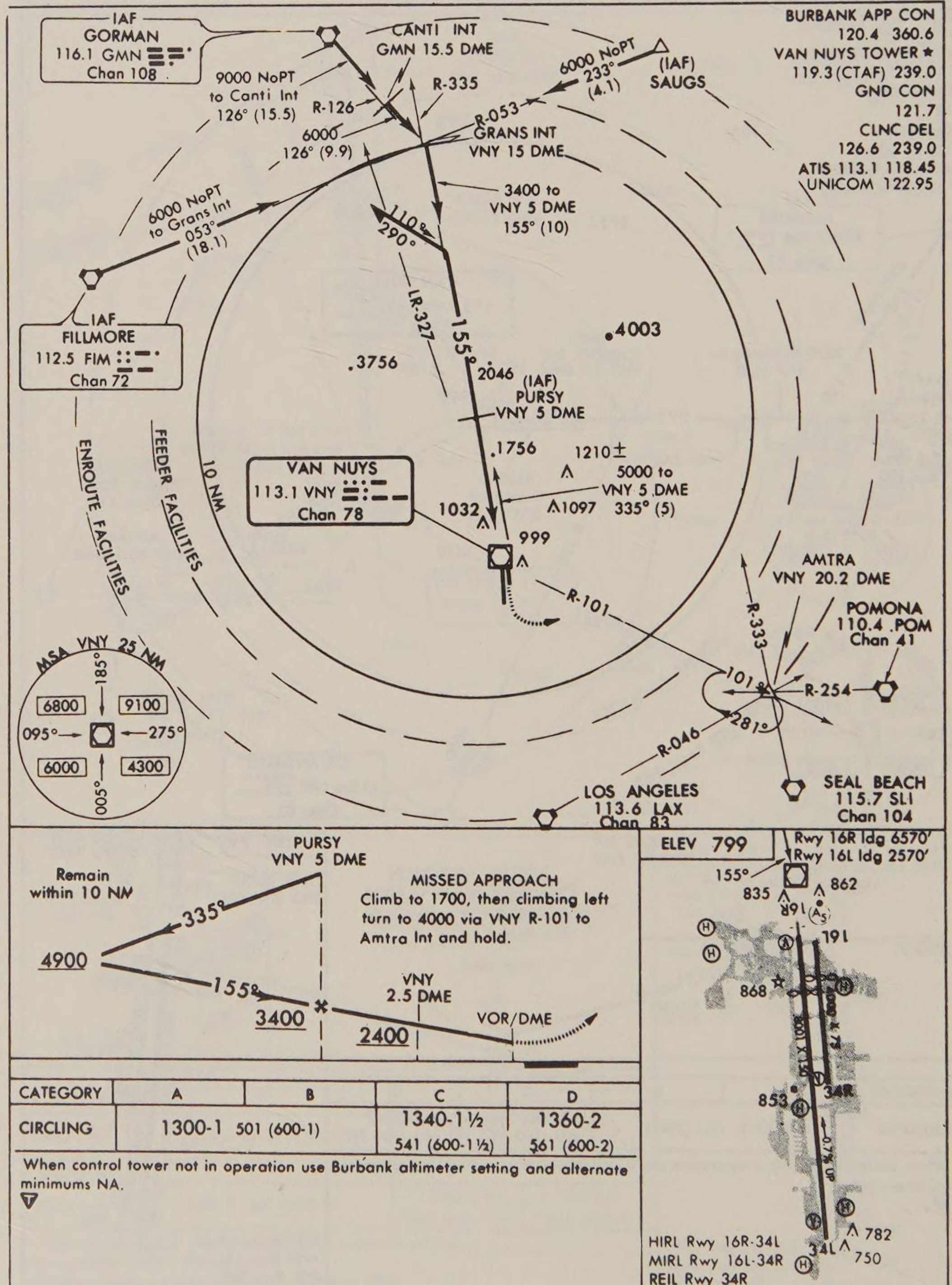
Not for use in Navigation

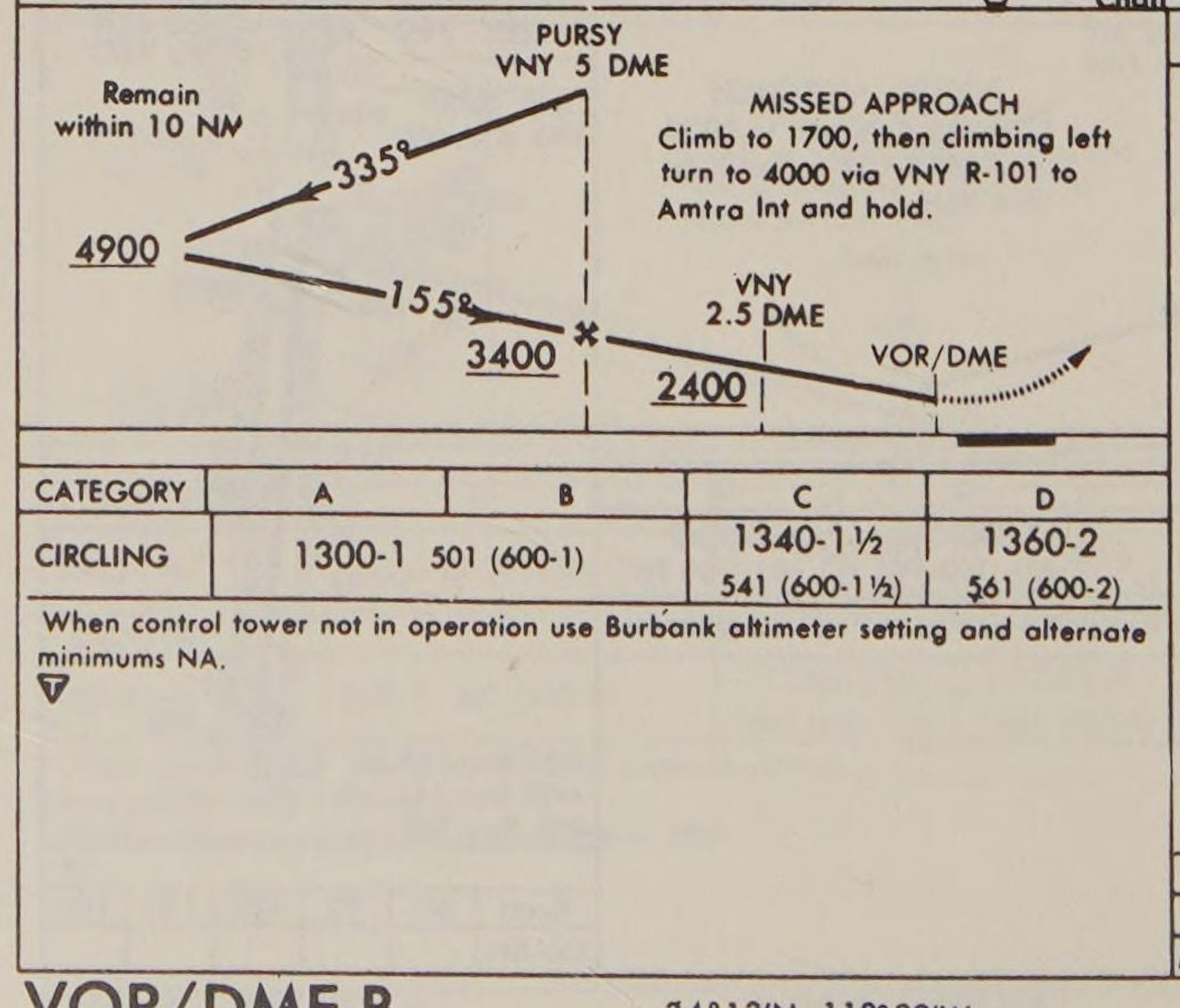
Amdt 1

VOR/DME-B

VAN NUYS (VNY)

VAN NUYS, CALIFORNIA





CATEGORY	A	B	C	D
CIRCLING	1300-1 501 (600-1)		1340-1½ 541 (600-1½)	1360-2 561 (600-2)

When control tower not in operation use Burbank altimeter setting and alternate minimums NA.

▽

Knots	60	90	120	150	180
Min:Sec					

VOR/DME-B

34°13'N –118°29'W

VAN NUYS, CALIFORNIA

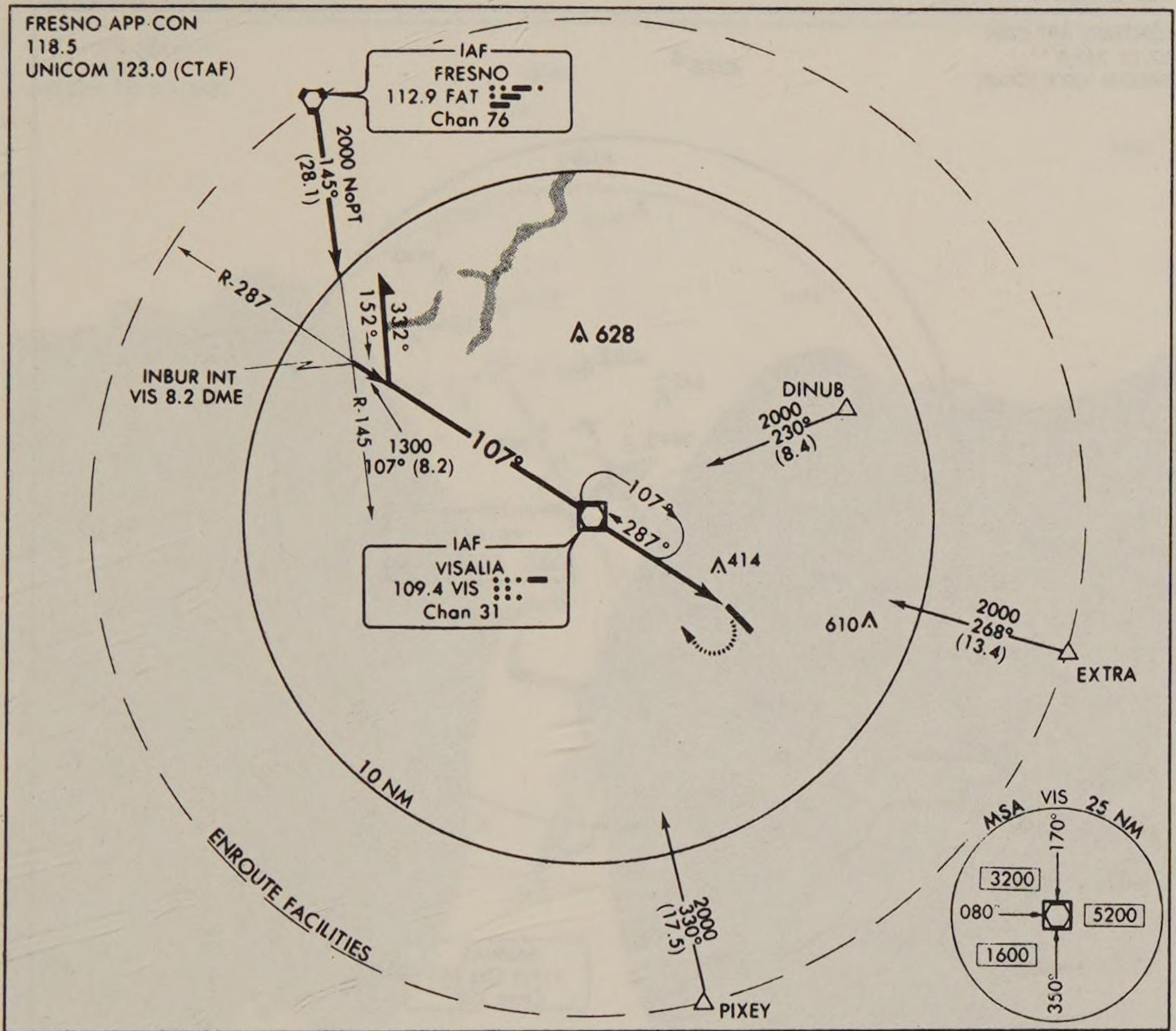
VAN NUYS (VNY)

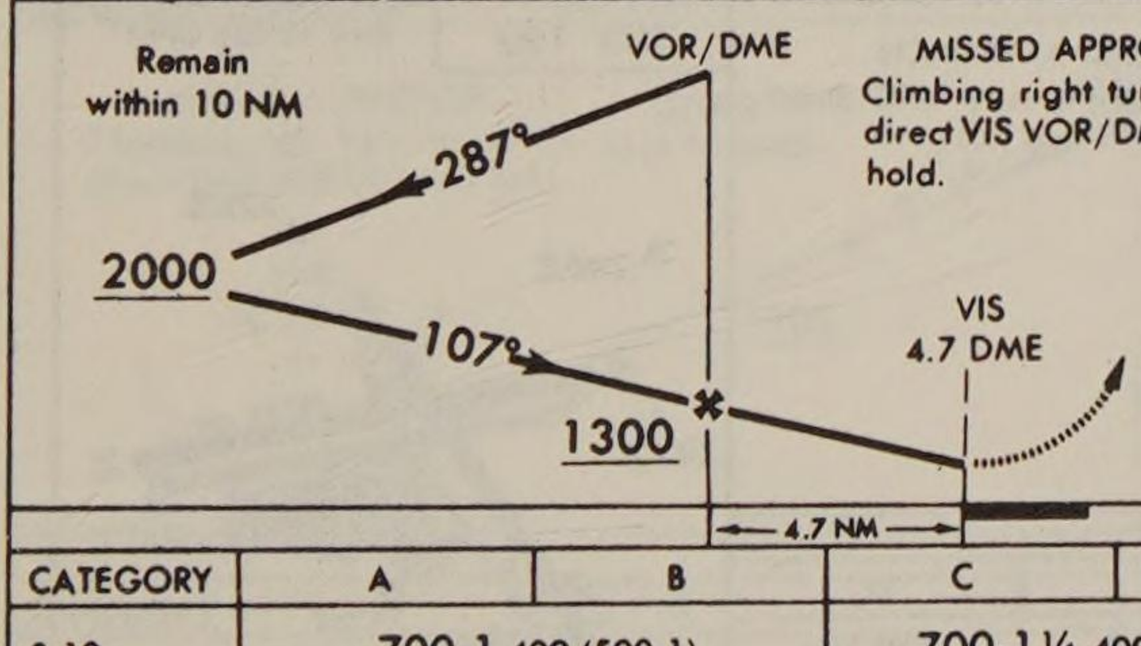
Not for use in Navigation

Amdt 3

VOR RWY 12

VISALIA MUNI (VIS)
VISALIA, CALIFORNIA

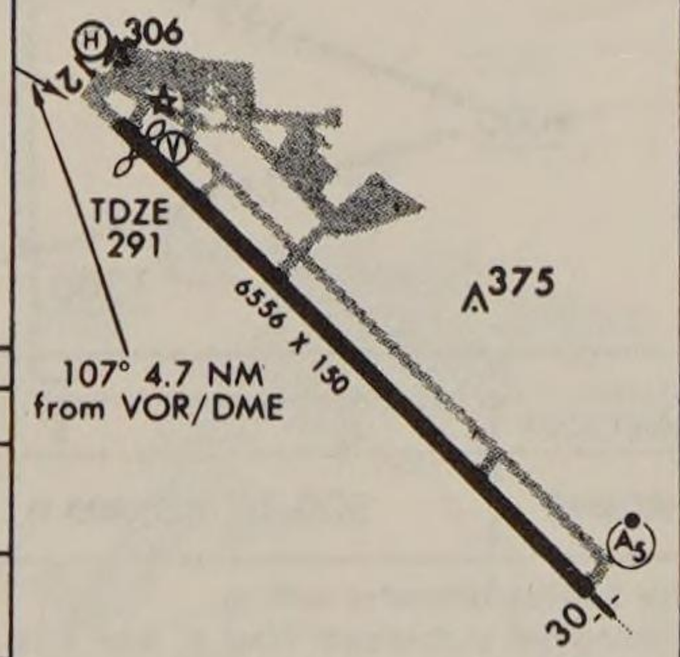




CATEGORY	A	B	C	D
S-12	700-1 409 (500-1)		700-1 ¼ 409 (500-1 ¼)	
CIRCLING	720-1 428 (500-1)	760-1 468 (500-1)	760-1 ½ 468 (500-1 ½)	860-2 568 (600-2)

ACTIVATE MALSR Rwy 30- UNICOM
When control zone not effective, the following applies, except for operators with approved weather reporting service: 1. Use Fresno altimeter setting.
2. Increase all MDAs 140 feet. 3. Alternate minimums not authorized.

ELEV 292 — Rwy 12 ldg 6271'



REIL Rwy 12
MIRL Rwy 12-30

FAF to MAP 4.7 NM					
Knots	60	90	120	150	180
Min:Sec	4:42	3:08	2:21	1:53	1:34

VOR RWY 12

36°19'N – 119°24'W

VISALIA, CALIFORNIA
VISALIA MUNI (VIS)

Not for use in Navigation

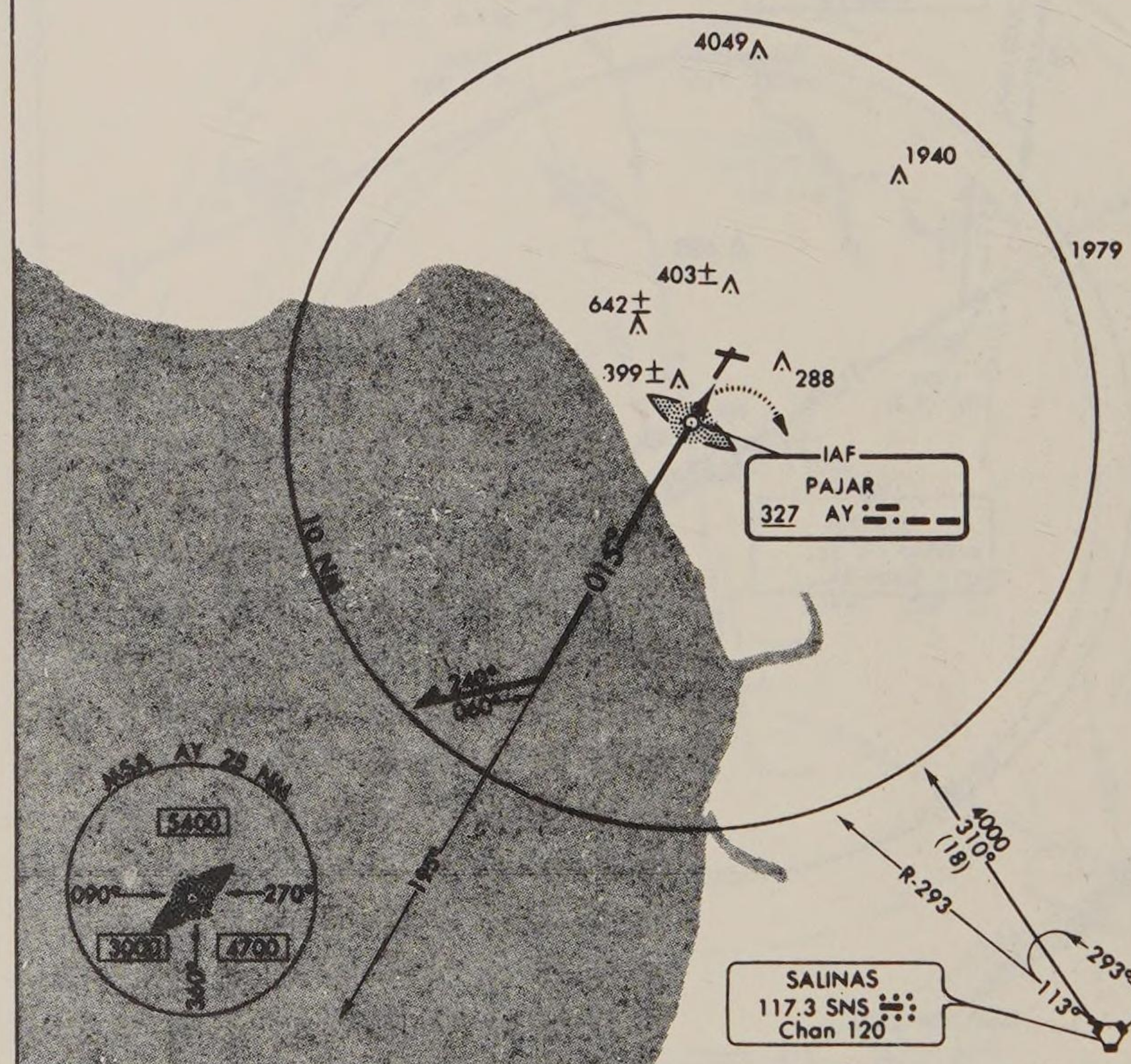
Amdt 1
NDB-B

WATSONVILLE MUNI (WVI)
WATSONVILLE, CALIFORNIA

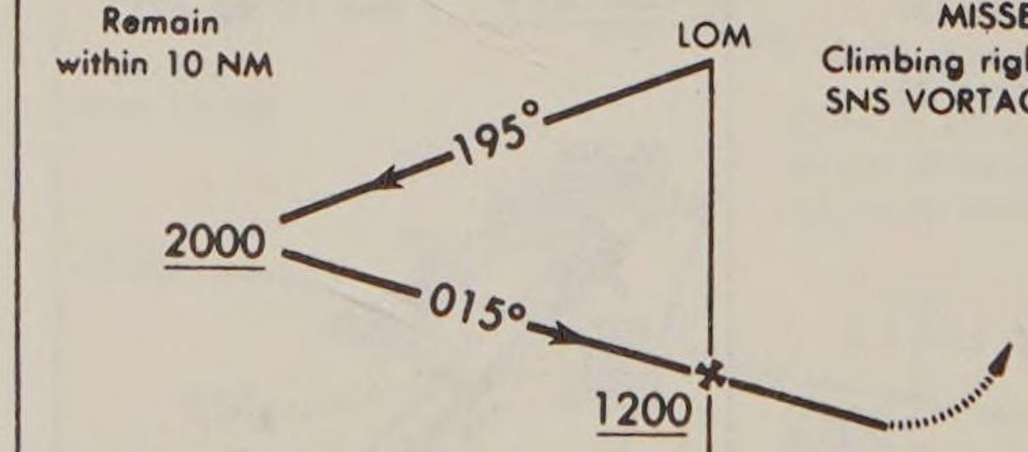
MONTEREY APP CON
127.15 263.6
UNICOM 122.8 (CTAF)

4085^

2790•



Remain within 10 NM



MISSED APPROACH
Climbing right turn to 4000 direct SNS VORTAC and hold.

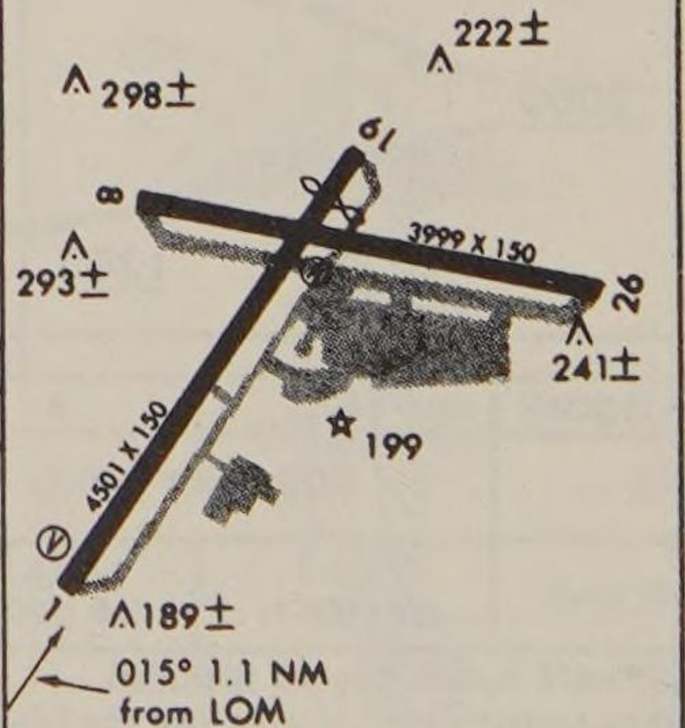
CATEGORY	A	B	C	D
CIRCLING	900-1 740 (800-1)		900-2 740 (800-2)	900-2¼ 740 (800-2¼)

Use Salinas altimeter setting.
Circling not authorized West of Rwy 1-19.
ACTIVATE MIRL Rwy 1-19, VASI Rwy 19 and REIL Rwy 1-CTAF.

NA

ELEV 160

Rwy 19 ldg 3901'



MIRL Rwy 1-19
REIL Rwy 1

FAF to MAP 1.1 NM					
Knots	60	90	120	150	180
Min:Sec	1:06	0:44	0:33	0:26	0:22

NDB-B

36°56'N-121°47'W

WATSONVILLE, CALIFORNIA
WATSONVILLE MUNI (WVI)

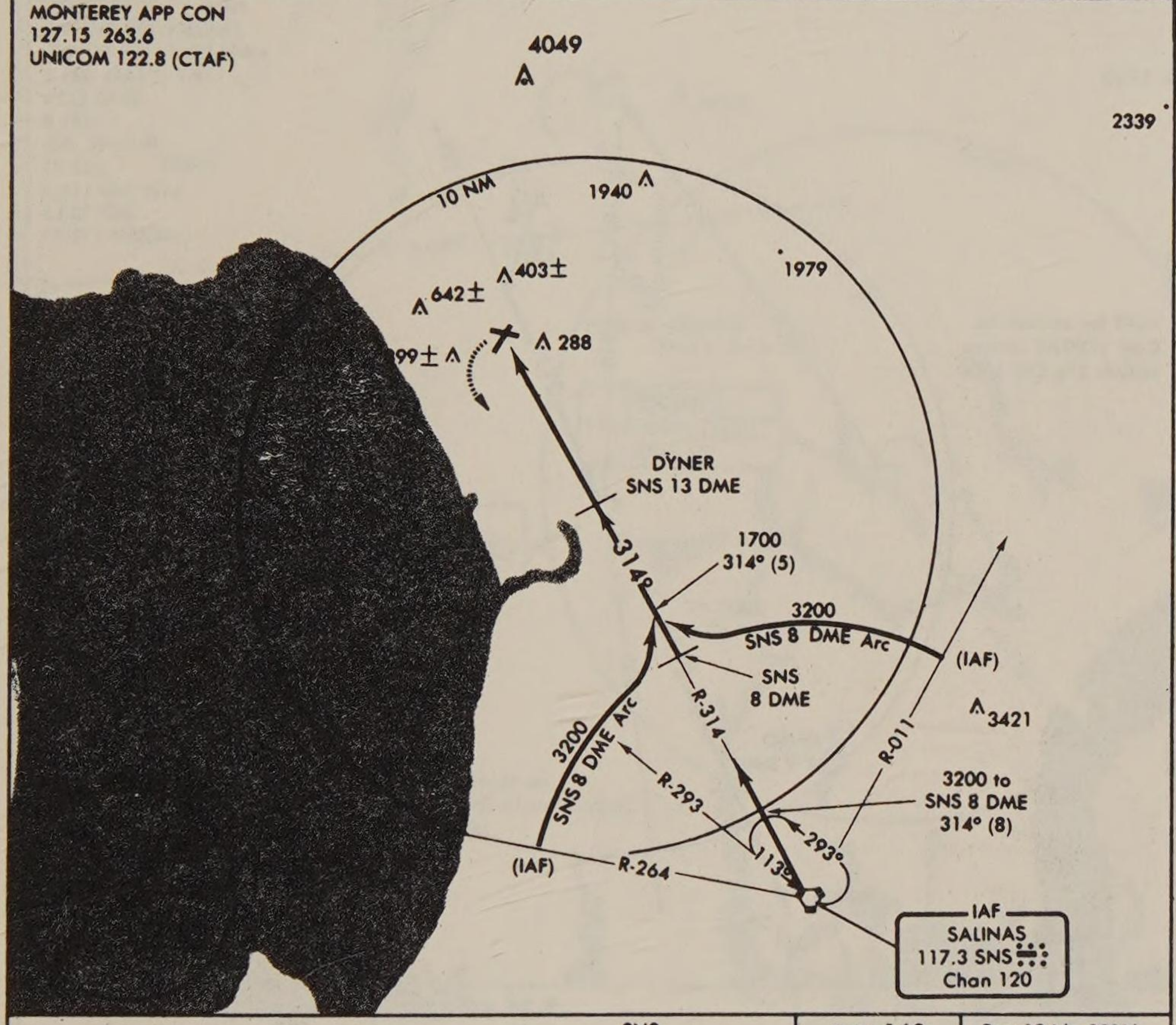
Not for use in Navigation

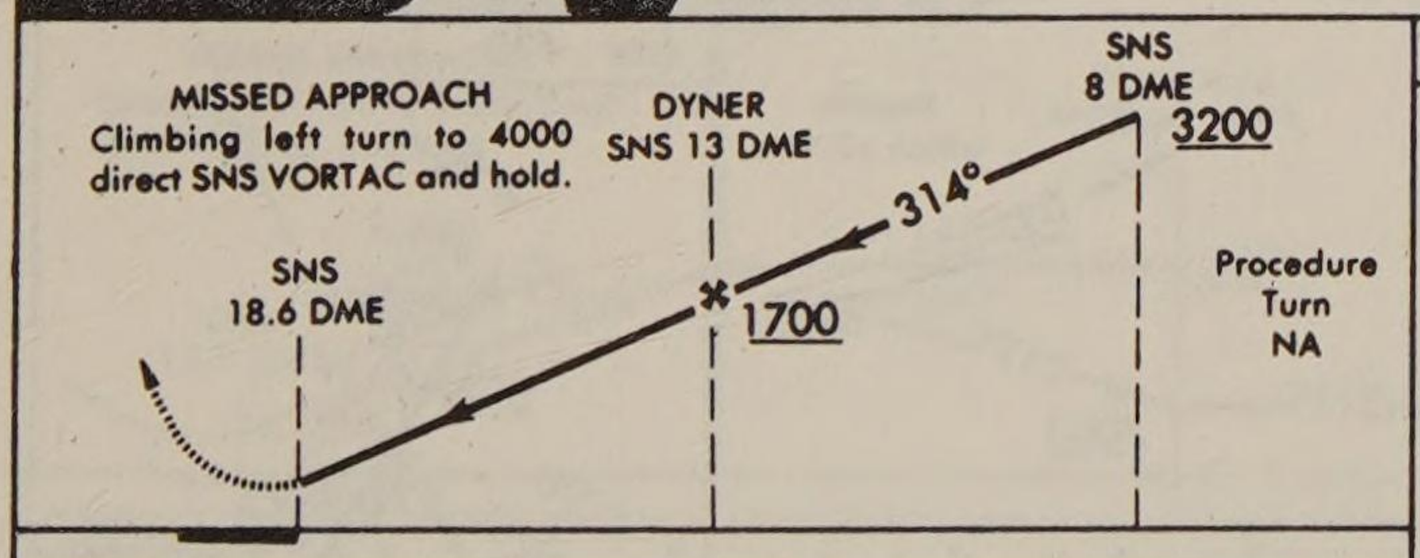
Orig

VOR/DME-A

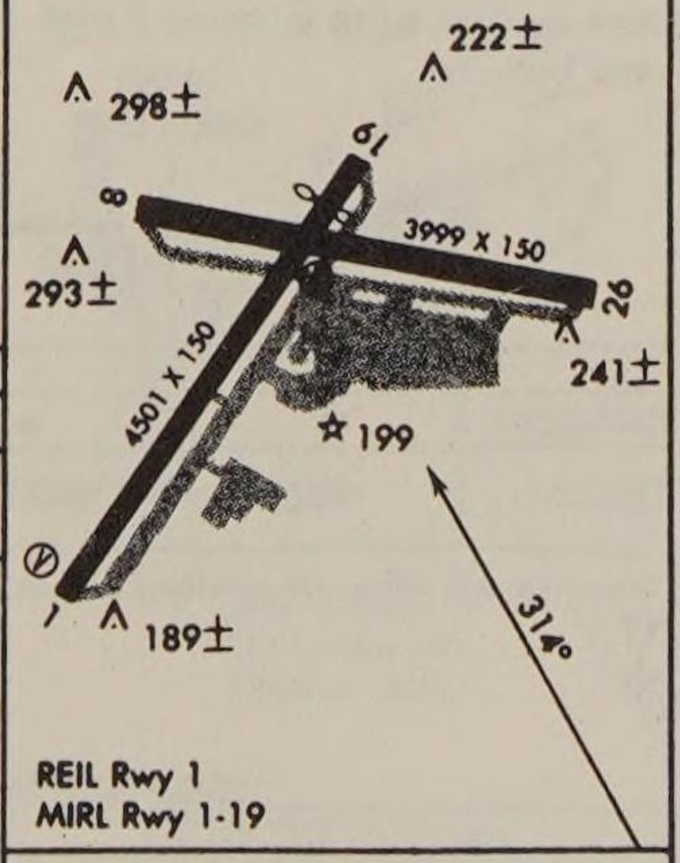
WATSONVILLE MUNI (WVI)
WATSONVILLE, CALIFORNIA

MONTEREY APP CON
127.15 263.6
UNICOM 122.8 (CTAF)





ELEV 160 | Rwy 19 ldg 3901'



CATEGORY	A	B	C	D
CIRCLING	1300-1¼ 1140 (1200-1¼)	1300-1½ 1140 (1200-1½)	1300-3 1140 (1200-3)	

Use Salinas altimeter setting.
Circling not authorized west of Rwy 1-19.
ACTIVATE MIRL Rwy 1-19, VASI Rwy 19 and REIL Rwy 1- CTAF

T
A NA

Knots	60	90	120	150	180
Min:Sec					

VOR/DME-A

36°56'N – 121°47'W

WATSONVILLE, CALIFORNIA
WATSONVILLE MUNI (WVI)

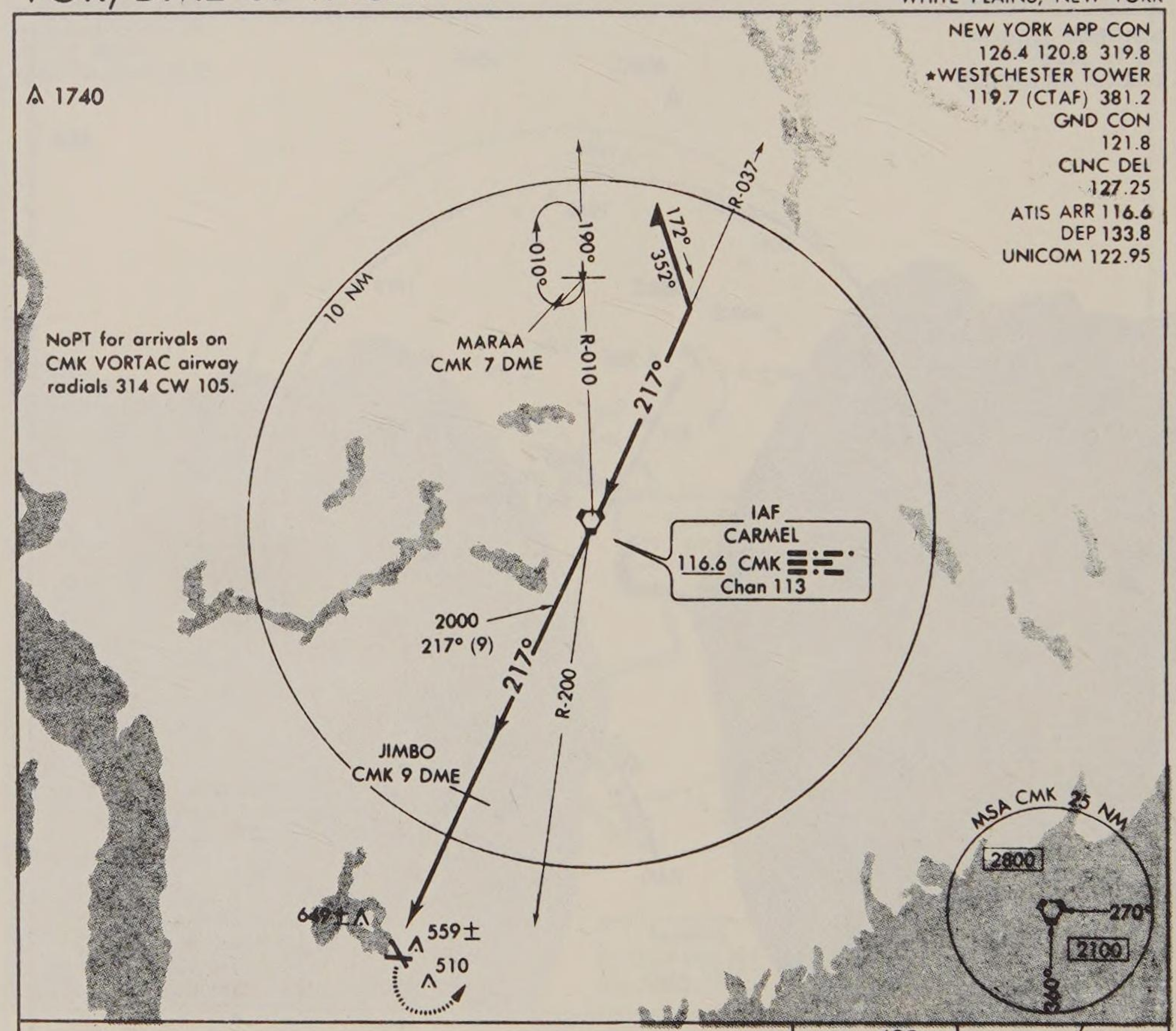
Not for use in Navigation

Amdt 2

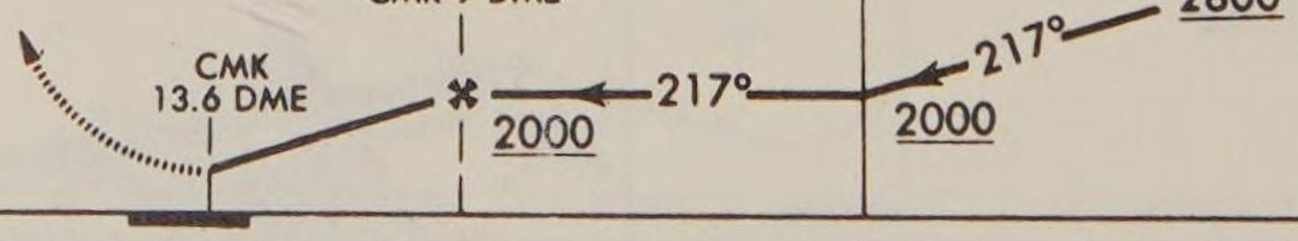
VOR/DME or TACAN-A

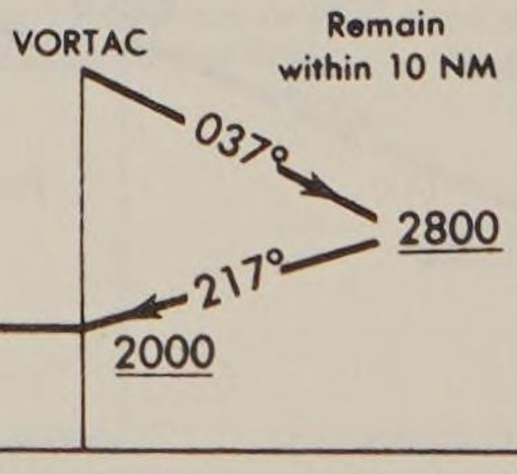
WHITE PLAINS/WESTCHESTER CO (HPN)
WHITE PLAINS, NEW YORK

NEW YORK APP CON
126.4 120.8 319.8
★WESTCHESTER TOWER
119.7 (CTAF) 381.2
GND CON
121.8
CLNC DEL
127.25
ATIS ARR 116.6
DEP 133.8
UNICOM 122.95



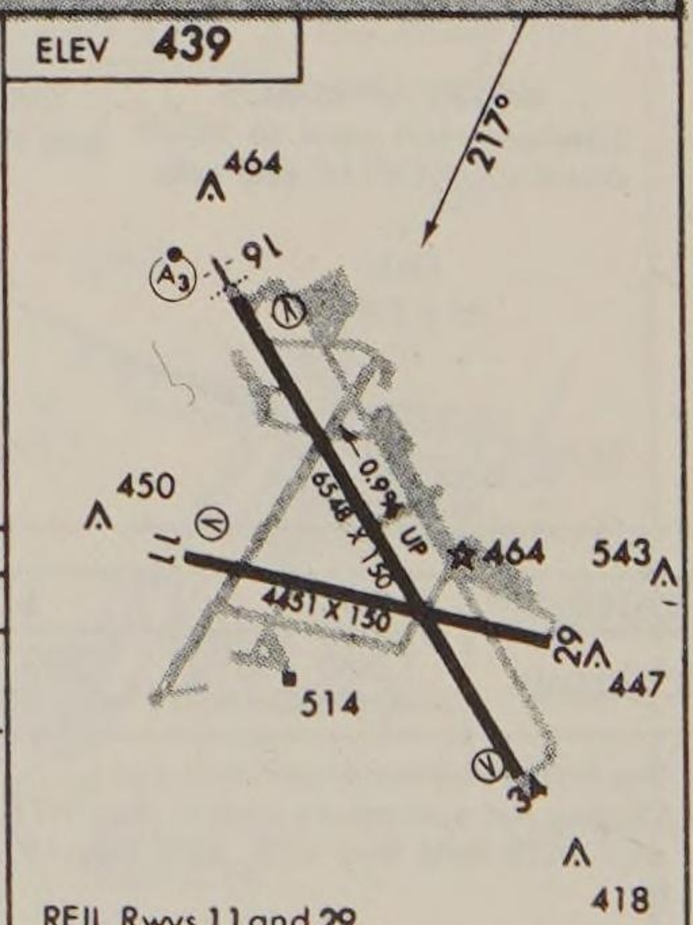
MISSED APPROACH
Climbing left turn to 2000 via heading 050°and CMK R-200 to CMK VORTAC then via CMK R-010 to Maraa 7 DME and hold.





CATEGORY	A	B	C	D
CIRCLING	980-1	541 (600-1)	980-1 ½ 541 (600-1 ½)	1000-2 561 (600-2)

When control zone not in effect obtain local altimeter on UNICOM.



REIL Rwys 11 and 29
MIRL Rwy 11-29
HIRL Rwy 16-34

Knots	60	90	120	150	180
Min:Sec					

VOR/DME or TACAN-A

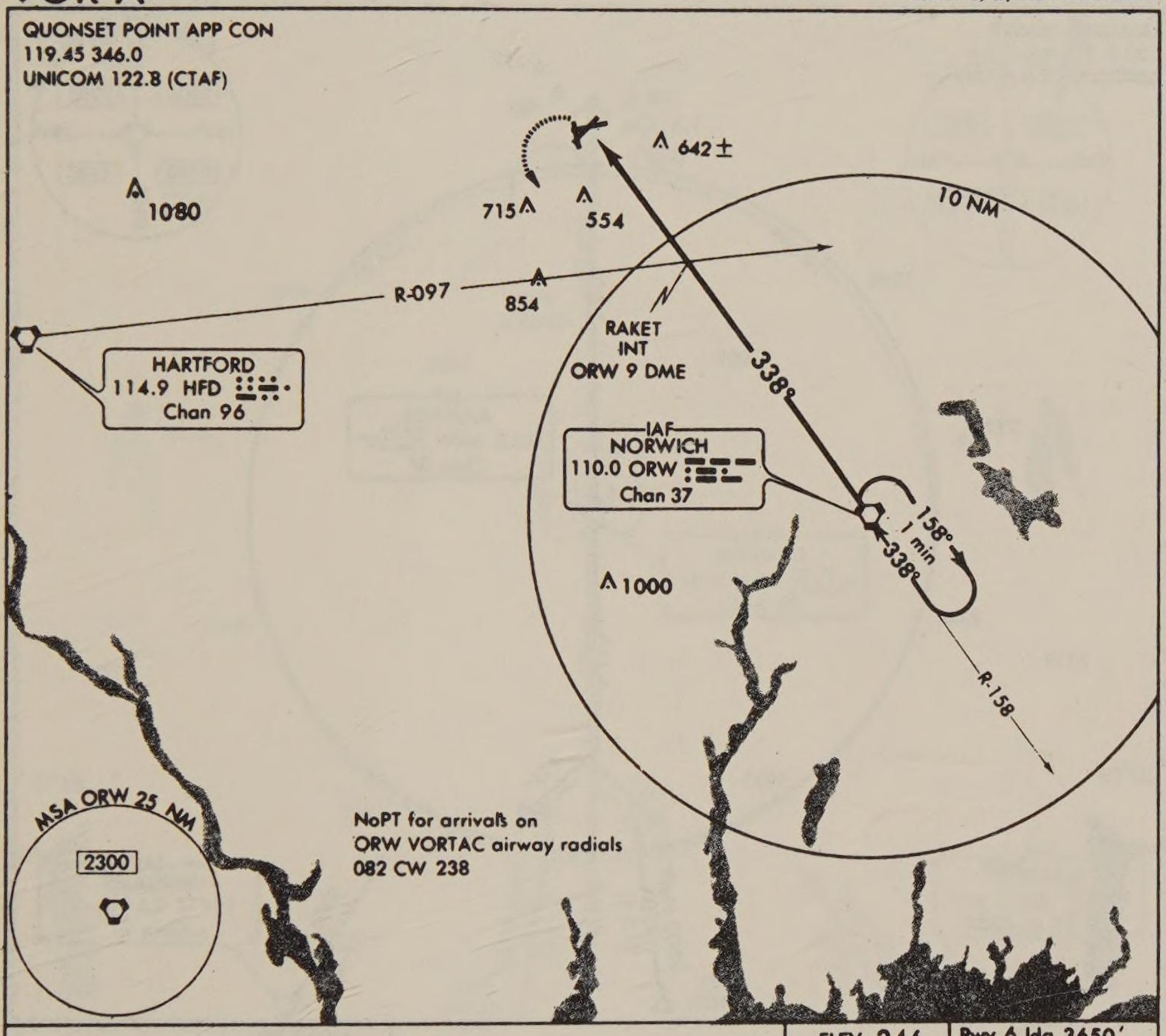
41°04'N – 73°43'W

WHITE PLAINS, NEW YORK
WHITE PLAINS/WESTCHESTER CO (HPN)

Not for use in Navigation

Amdt 5
VOR-A

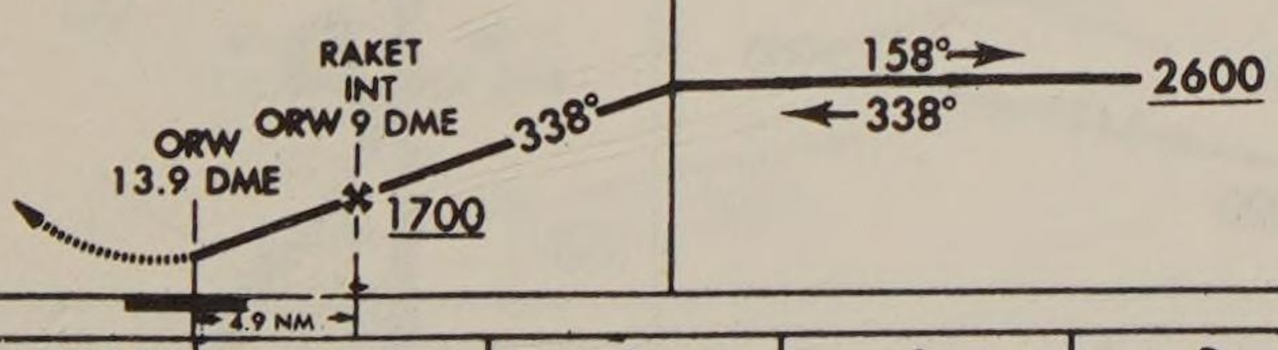
WILLIMANTIC/WINDHAM (5BØ)
WILLIMANTIC, CONNECTICUT



VORTAC

MISSED APPROACH
Climbing left turn to 2600 direct
ORW VORTAC and hold.

One minute
holding pattern

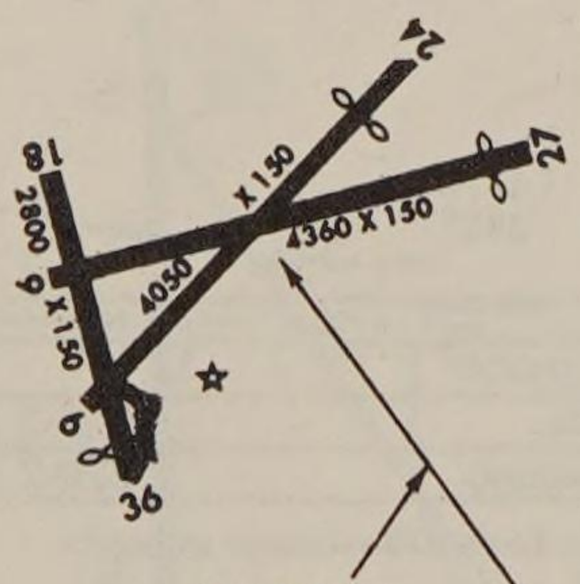


CATEGORY	A	B	C	D
CIRCLING	1060-1 814 (900-1)	1060-1¼ 814 (900-1¼)	1080-2½ 834 (900-2½)	NA

Use Windsor Locks altimeter setting.
ACTIVATE MIRL Rwy 9-27-UNICOM.
▼
△NA

ELEV 246

Rwy 6 ldg 3650'
Rwy 24 ldg 3500'
Rwy 36 ldg 2550'
Rwy 27 ldg 4036'



MIRL Rwy 9-27

FAF to MAP 4.9 NM					
Knots	60	90	120	150	180
Min:Sec	4:54	3:16	2:27	1:58	1:38

VOR-A

41°45'N-72°11'W

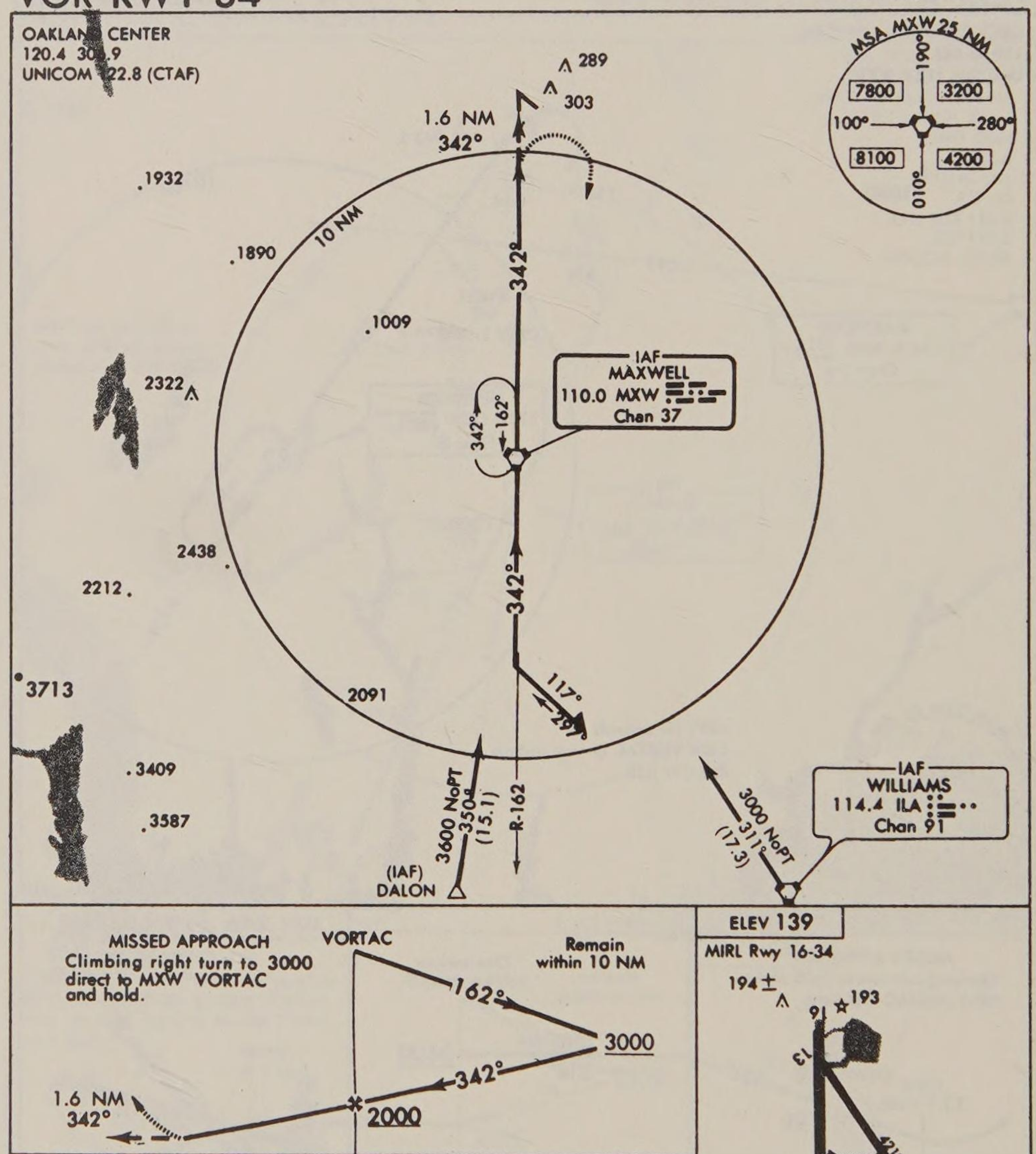
WILLIMANTIC, CONNECTICUT
WILLIMANTIC/WINDHAM (5BØ)

Not for use in Navigation

Amdt 4

VOR RWY 34

WILLOWS-GLENN COUNTY (WLW)
WILLOWS, CALIFORNIA



CATEGORY	A	B	C	D
S-34	820-2 685 (700-2)			NA
CIRCLING	820-2 682 (700-2)			NA

Use Beale AFB altimeter setting.

T
A NA

FAF to MAP 10 NM					
Knots	60	90	120	150	180
Min:Sec	10:00	6:40	5:00	4:00	3:20

VOR RWY 34

39°31'N–122°13'W

WILLOWS, CALIFORNIA
WILLOWS-GLENN COUNTY (WLW)

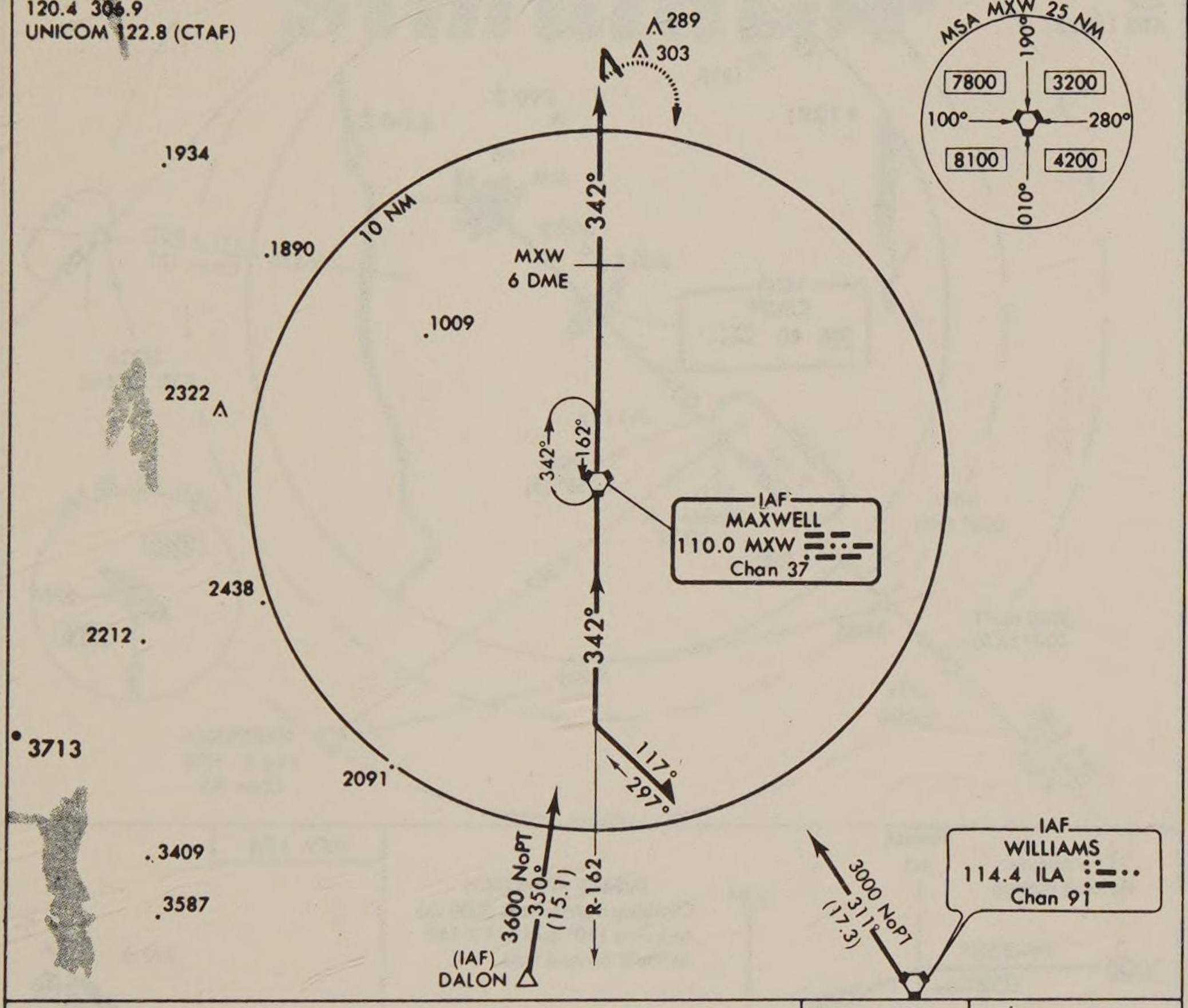
Not for use in Navigation

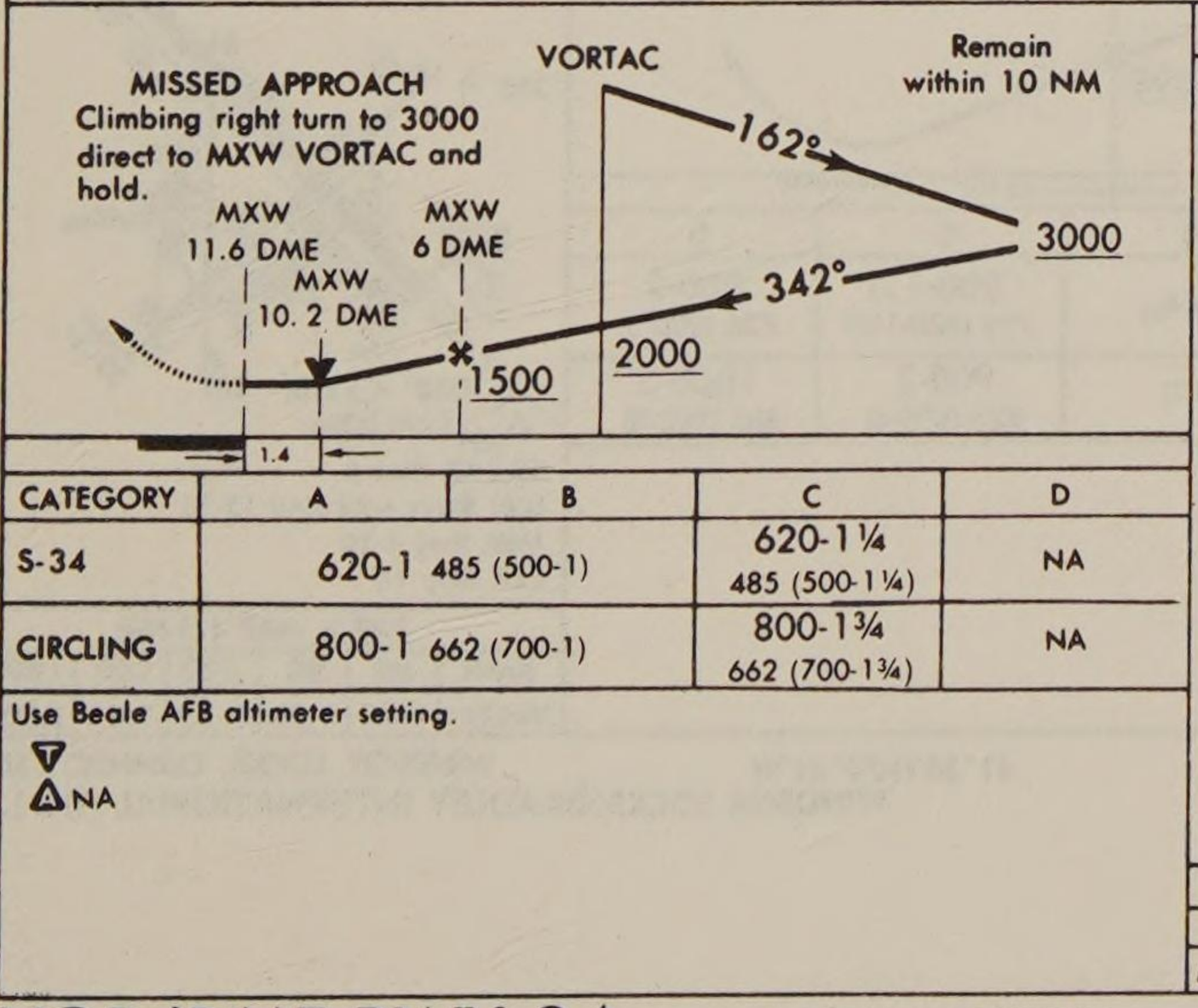
Amdt 4

VOR/DME RWY 34

WILLOWS-GLENN COUNTY (WLW)
WILLOWS, CALIFORNIA

OAKLAND CENTER
120.4 306.9
UNICOM 122.8 (CTAF)



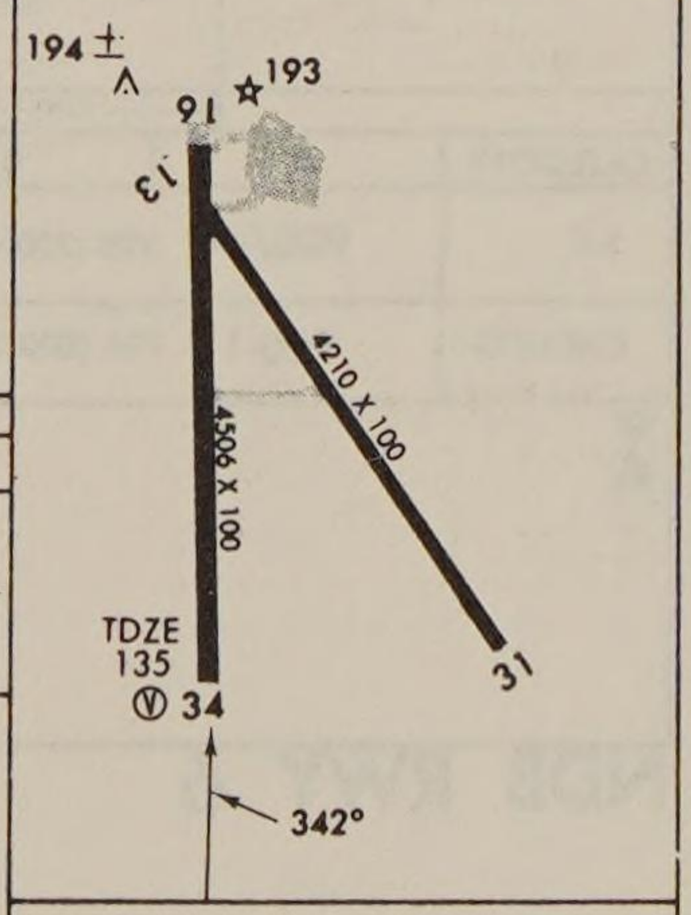


CATEGORY	A	B	C	D
S-34	620-1 485 (500-1)		620-1 1/4 485 (500-1 1/4)	NA
CIRCLING	800-1 662 (700-1)		800-1 3/4 662 (700-1 3/4)	NA

Use Beale AFB altimeter setting.

▼
▲ NA

ELEV 139 | MIRL Rwy 16-34



Knots	60	90	120	150	180
Min:Sec					

VOR/DME RWY 34

39°31'N – 122°13'W

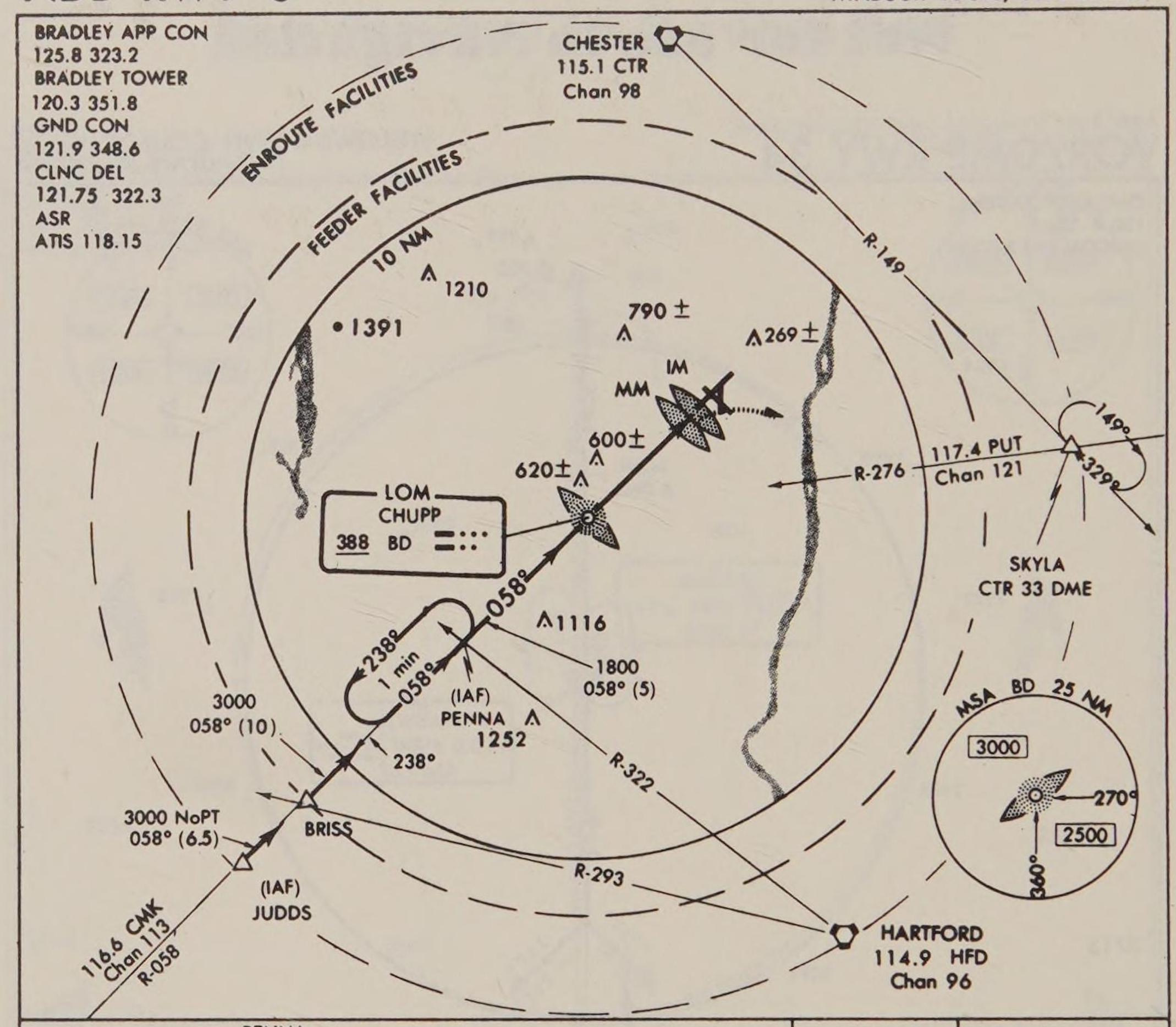
WILLOWS, CALIFORNIA
WILLOWS-GLENN COUNTY (WLW)

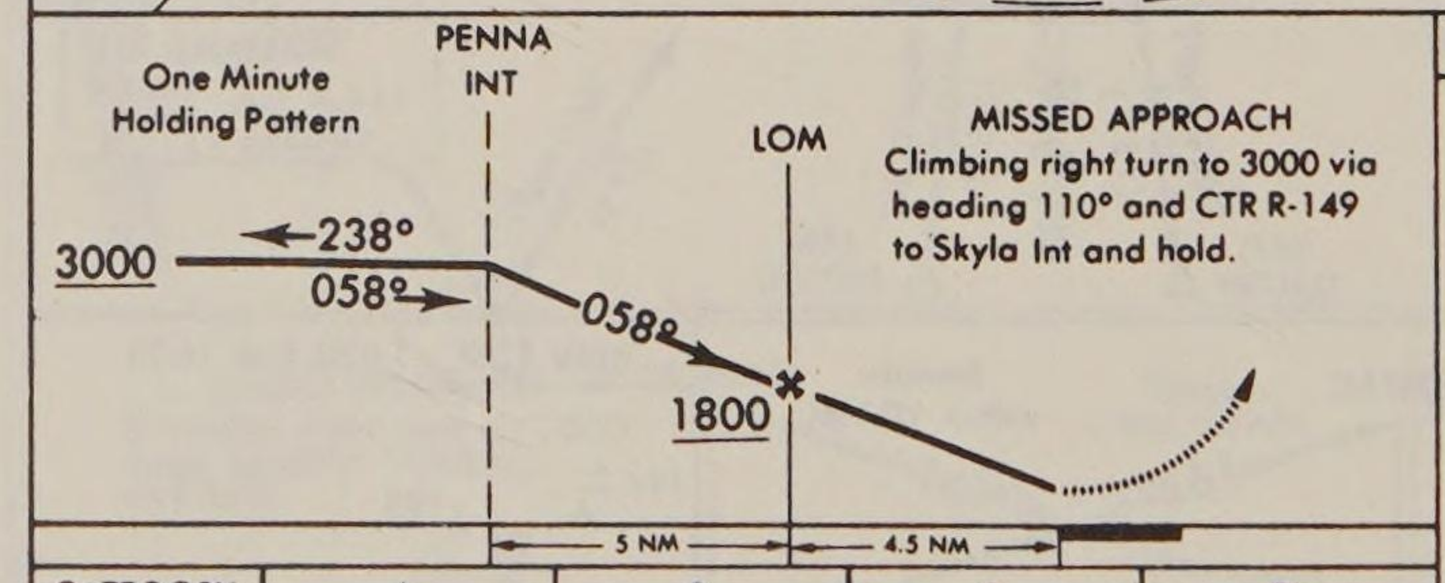
Not for use in Navigation

Amdt 24

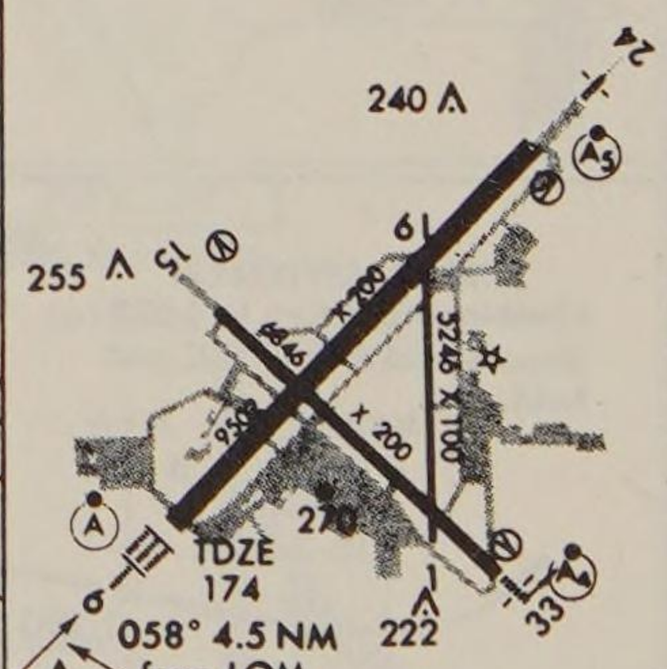
NDB RWY 6

WINDSOR LOCKS/BRADLEY INTERNATIONAL (BDL)
WINDSOR LOCKS, CONNECTICUT





ELEV 174



CATEGORY	A	B	C	D
S-6	900/40	726 (800-¾)	900-1½ 726 (800-1½)	900-2 726 (800-2)
CIRCLING	900-1	726 (800-1)	900-2 726 (800-2)	1060-3 886 (900-3)

TDZ/CL Rwy 6
HIRL Rwys 6-24 and 15-33
MIRL Rwy 1-19
REIL Rwy 15

FAF to MAP 4.5 NM					
Knots	60	90	120	150	180
Min:Sec	4:30	3:00	2:15	1:48	1:30

NDB RWY 6

41°56'N-72°41'W

WINDSOR LOCKS, CONNECTICUT
WINDSOR LOCKS/BRADLEY INTERNATIONAL (BDL)

Appendix C

En Route Charts for *Flight Simulator*

NEW YORK AND BOSTON AREA CHART

FLIGHT SIMULATOR II REFERENCE CHART
NOT TO BE USED FOR REAL WORLD AERIAL NAVIGATION

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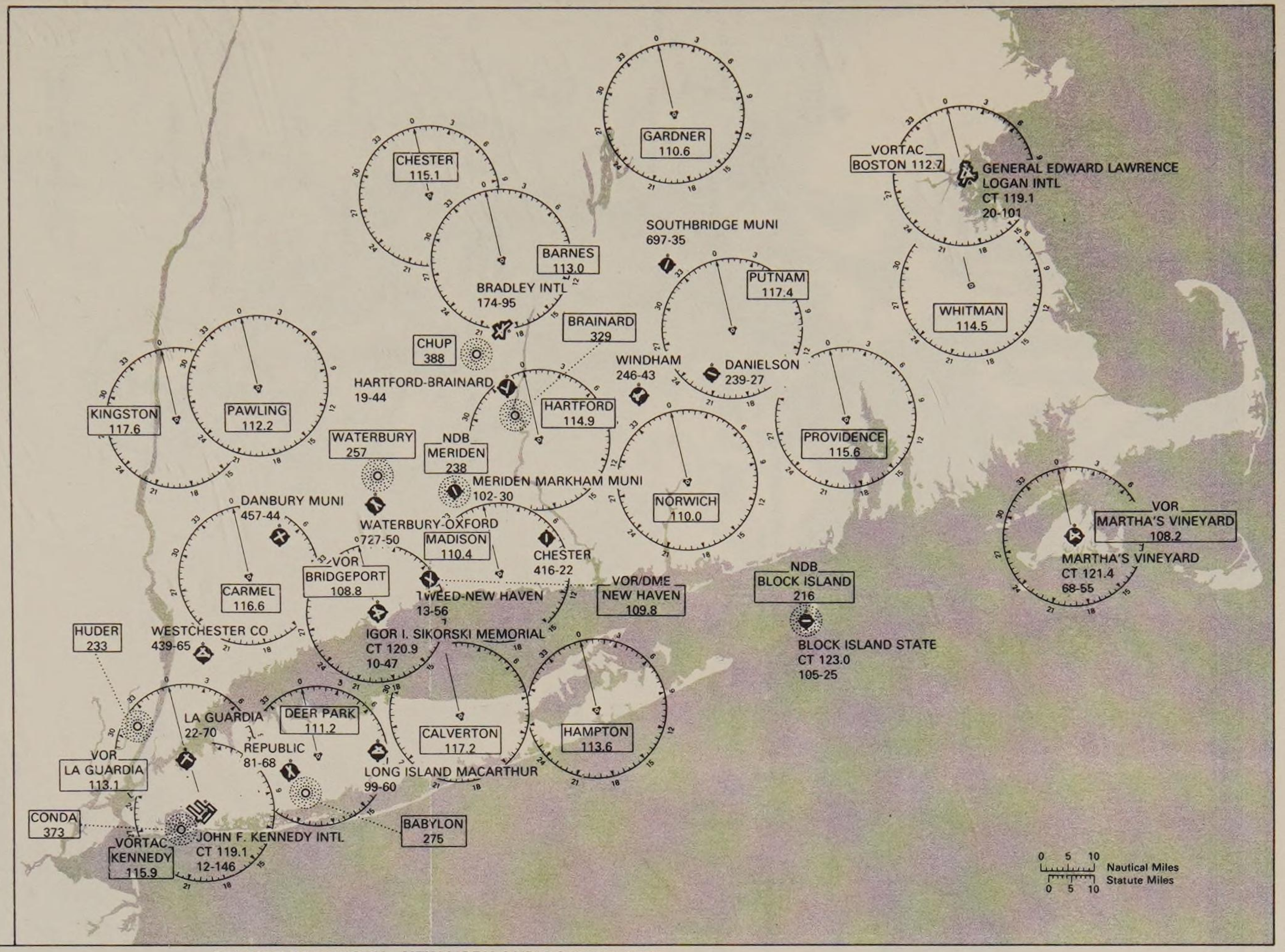


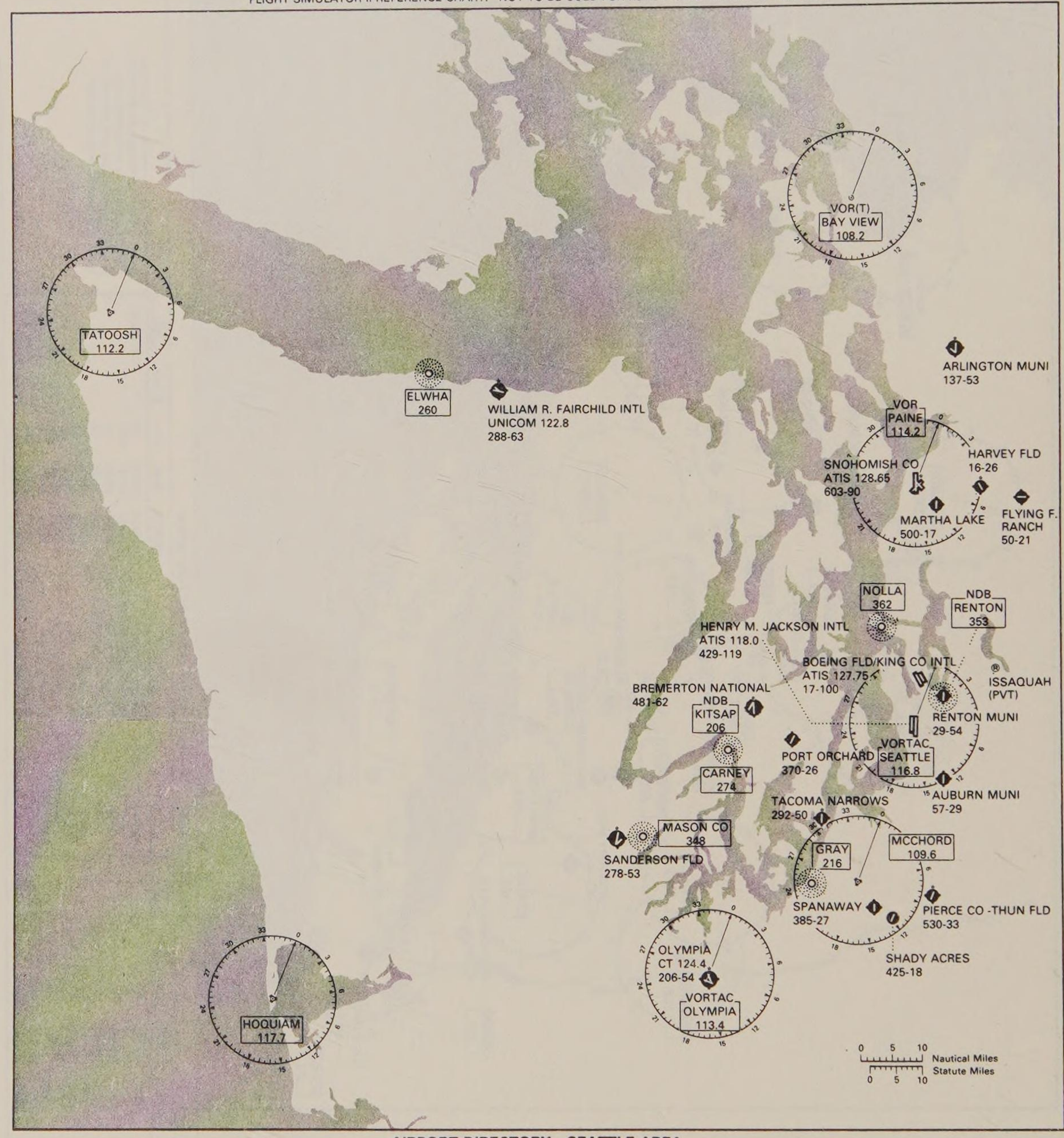
AIRPORT DIRECTORY—NEW YORK AND BOSTON AREA

CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq.)
Block Island	Block Island State	17352	21749	105	*	
Boston	General Edward Lawrence Logan Intl.	17899	21853	20	*	
Bridgeport	Igor I. Sikorski Memorial	17287	21249	10	*	
Chester	Chester	17404	21434	416		
Danbury	Danbury Muni	17360	21120	457		
Danielson	Danielson	17617	21607	239		
Farmingdale	Republic	17089	21177	81		
Hartford	Hartford-Brainard	17551	21371	19		
Islip	Long Island MacArthur	17132	21278	99		
Marthas Vineyard	Marthas Vineyard	17490	22043	68	*	24/108.7
Meriden	Meriden Markham Muni	17447	21327	102		
New Haven	Tweed-New Haven	17339	21322	13		
New York	John F. Kennedy Intl	17034	21065	12	*	
New York	La Guardia	17091	21026	22		
Oxford	Waterbury-Oxford	17422	21229	727		
Southbridge	Southbridge Muni	17733	21543	697		
White Plains	Westchester Co	17226	21065	439		
Willimantic	Windham	17573	21521	246		
Windsor Locks	Bradley Intl	17638	21351	174		

North and east coordinates are canted at + 10° (clockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal conic projection.

SEATTLE AREA CHART

FLIGHT SIMULATOR II REFERENCE CHART. NOT TO BE USED FOR REAL WORLD AERIAL NAVIGATION



AIRPORT DIRECTORY—SEATTLE AREA

CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq.)
Alderwood Manor	Martha Lake	21502	6670	500		
Arlington	Arlington Muni	21616	6737	137		
Auburn	Auburn Muni	21290	6586	57		
Bremerton	Bremerton National	21407	6470	481		
Everett	Snohomish Co	21525	6665	603	*	16/109.3
Issaquah	Issaquah	21362	6668	500	*	
Monroe	Flying F. Ranch	21481	6738	50		
Olympia	Olympia	21218	6343	206	*	
Puyallup	Pierce Co.-Thun Fld	21206	6534	530		
Port Angeles	William R. Fairchild Intl.	21740	6375	288	*	
Port Orchard	Port Orchard	21373	6483	370		
Renton	Renton Muni	21351	6612	29		
Seattle	Boeing Fld/King Co Intl	21376	6596	17	*	
Seattle	Henry M. Jackson Intl. (Seattle-Tacoma Intl)	21343	6584	429		
Shelton	Sanderson Fld.	21353	6316	278		
Snohomish Co. (Paine Field) see Everett						
Snohomish	Harvey Fld	21505	6711	16		
Spanaway	Shady Acres	21201	6501	425		
Spanaway	Spanaway	21215	6491	385		
Tacoma	Tacoma Narrows	21300	6480	292		

North and east coordinates are canted at −21° (counterclockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal conic projection.

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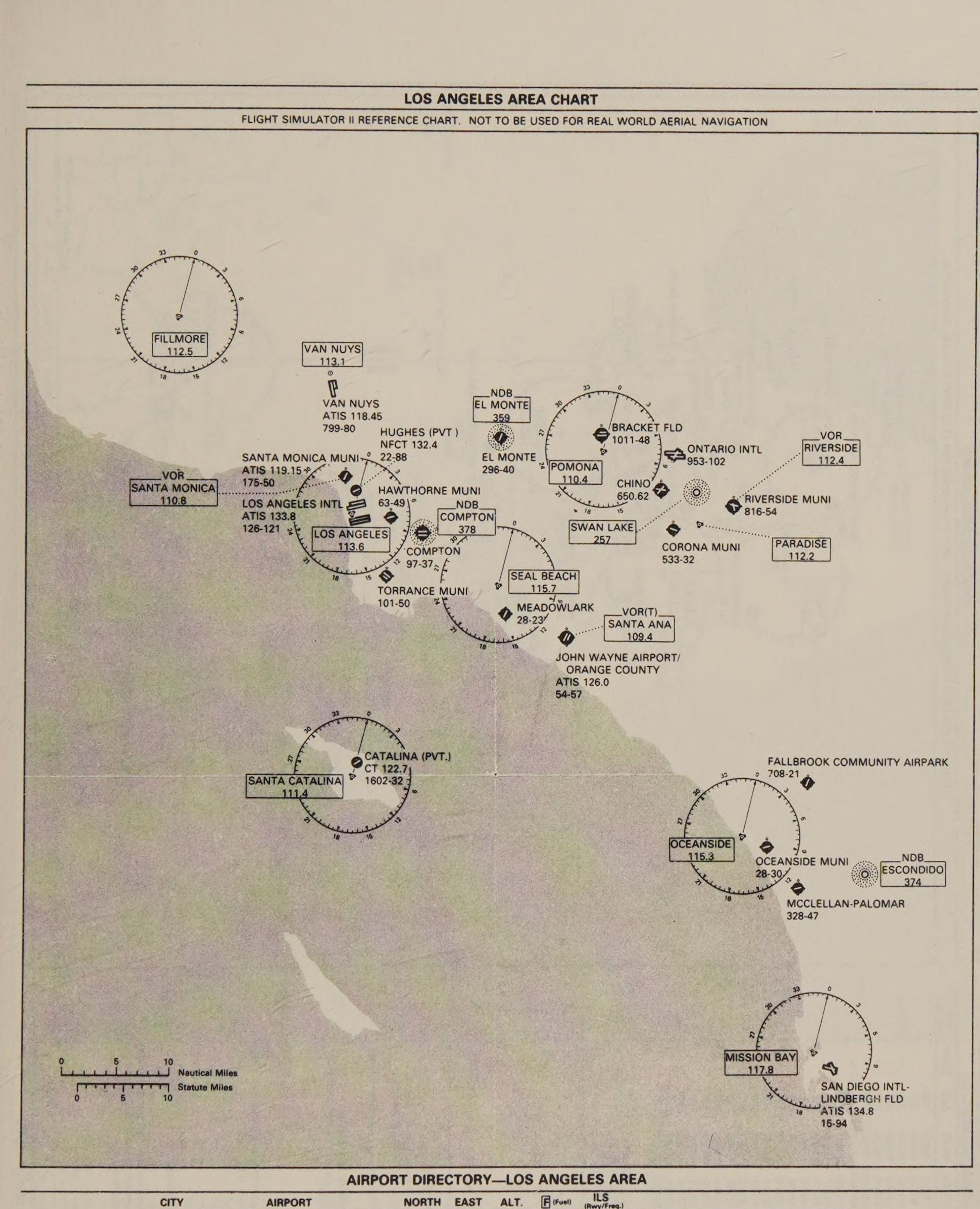
LOS ANGELES AREA CHART

FLIGHT SIMULATOR II REFERENCE CHART. NOT TO BE USED FOR REAL WORLD AERIAL NAVIGATION



AIRPORT DIRECTORY—LOS ANGELES AREA

CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq.)
Carlsbad	McClennan-Palomar	14931	6112	328		
	Catalina (PVT)	15149	5744	1602		
Chino	Chino	15319	6079	650		
Compton	Compton	15,334	5859	97		
Corona	Corona Muni	15280	6083	533		
El Monte	El Monte	15397	5952	296		
Fallbrook	Fallbrook Community Airpark	15023	6144	708		
Hawthorne	Hawthorne Muni	15358	5831	63		
Huntington Beach	Meadowlark	15244	5911	28		
LaVerne	Brackett Fld	15378	6038	1011		
Los Angeles	Hughes (PVT)	15386	5808	22	*	
Los Angeles	Los Angeles Intl	15374	5805	126	*	
Oceanside	Oceanside Muni	14974	6095	28		
Ontario	Ontario Intl	15347	6099	952		
Riverside	Riverside Muni	15288	6141	816		
San Diego	San Diego Intl-Lingbergh Fld	14761	6102	15	*	
Santa Ana	John Wayne Airport/ Orange County	15211	5961	54		
Santa Monica	Santa Monica Muni	15402	5799	175	*	
Torrance	Torrance Muni	15308	5815	101		
Van Nuys	Van Nuys	15498	5811	799	*	16R/111.3

North and east coordinates are canted at – 19° (counterclockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal conic projection.

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AIRPORT DIRECTORY—CHICAGO AREA

CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq.)
Aurora	Aurora Muni	17152	16393	706		
Bloomington	Bloomington-Normal	16593	16246	875		
Champaign (Urbana)	University of Illinois Willard	16400	16465	754	*	31/109.1
Chicago	Chicago Midway	17156	16628	619	*	
Chicago	Chicago-O'Hare Intl	17243	16578	667	*	
Chicago	Lansing Muni	17049	16697	614		
Chicago	Merrill C. Meigs	17189	16671	592	*	
Chicago/Blue Island	Howel	17100	16627	600		
Chicago/Schaumburg	Schaumburg Air Park	17247	16515	795		
Chicago(West Chicago)	DuPage	17213	16466	757		
Danville	Vermilion Co	16471	16685	695		
Dwight	Dwight	16874	16404	630		
Frankfort	Frankfort	17025	16596	775		
Gibson City	Gibson City Muni	16594	16461	759		
Joliet	Joliet Park District	17038	16490	582		
Kankakee	Greater Kankakee	16846	16597	625	*	
Monee	Sanger	16980	16646	786		
Morris	Morris Muni	17004	16413	588		
New Lenox	New Lenox-Howell	17025	16571	745		
Paxton	Paxton	16578	16507	780		
Plainfield	Clow Intl	17116	16502	670		
Romeoville	Lewis University	17081	16518	672		
Urbana	Frasca Field	16448	16482	735		

North and east coordinates align with orthogonal coordinate grid overlaid on Lambert conformal conic projection.

LEGEND

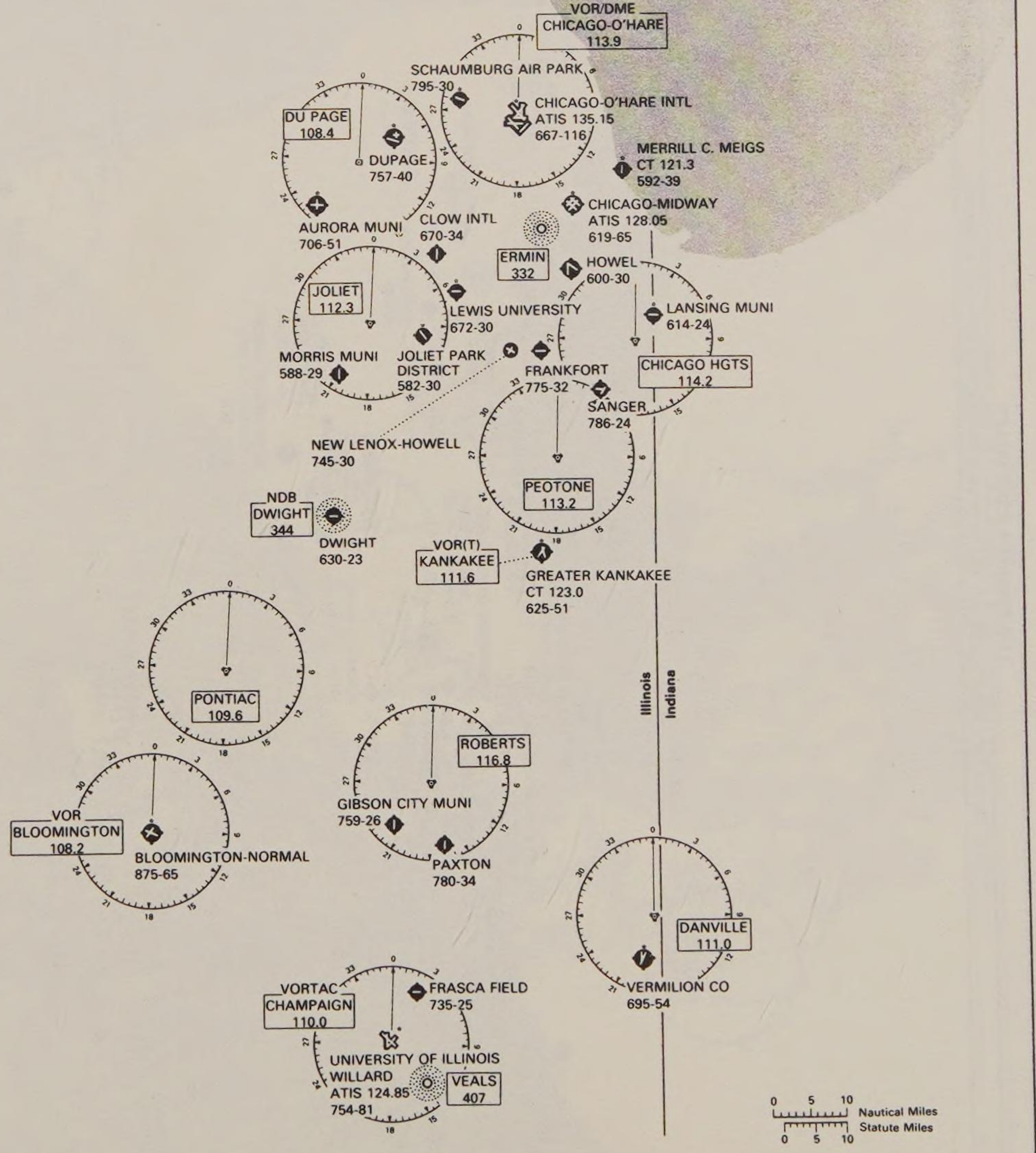
	Civil-Public use airport
®	Restricted/Private-Nonpublic use airport, having emergency use or landmark value
☆	Rotating light in operation, sunset to sunrise
SANTA MONICA ATIS 119.15 175-50	Airport Name Advisory Frequency (if available) Elevation (feet) — Length (hundreds of feet)
NAME FREQUENCY ⊙	VOR
NAME FREQUENCY ▽	VORTAC (Distance Measuring Equipment Able)
NAME FREQUENCY ⊙	VOR/DME
NAME FREQUENCY	Non Directional Beacon
VOR/DME NAME FREQUENCY	If VOR falls directly on an airport, only the airport symbol will be shown. The VOR facility type is shown at the top of the box.

AIRPORT NAME ABBREVIATIONS

CO	County
FLD	Field
INTL	International
MUNI	Municipal
(PVT)	Private Airport (prior permission before landing)

CHICAGO AREA CHART

FLIGHT SIMULATOR II REFERENCE CHART. NOT TO BE USED FOR REAL WORLD AERIAL NAVIGATION



AIRPORT DIRECTORY—SAN FRANCISCO AREA

CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq.)
Alameda NAS	Nimitz Field	17402	5102	13		
Antioch	Antioch	17407	5295	185		
Concord	Buchanan Field	17449	5214	23	*	
Fremont	Fremont	17226	5177	4		
Half Moon Bay	Half Moon Bay	17312	5004	67		
Hayward	Hayward Air Terminal	17329	5145	47		
Livermore	Livermore Muni	17304	5247	397	*	25/110.5
Mountain View	Moffett Field NAS	17220	5134	34		
Oakland	Oakland Intl	17365	5124	7	*	11/111.9 29/108.7
Palo Alto	Palo Alto	17245	5119	5		
San Carlos	San Carlos	17281	5084	2		
San Francisco	San Francisco Intl	17340	5060	10	*	28L/109.5
San Jose	San Jose Intl	17185	5164	56		12R/111.1
San Jose	Reid-Hillview	17160	5194	133		
San Rafael	Hamilton Army	17534	5082	3		
Tracy	Tracy Muni	17258	5366	192	*	

North and east coordinates are canted at −20° (clockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal conic projection.

LEGEND

	Civil-Public use airport
®	Restricted/Private-Nonpublic use airport, having emergency use or landmark value
☆	Rotating light in operation, sunset to sunrise
SANTA MONICA ATIS 119.15 175-50	Airport Name Advisory Frequency (if available) Elevation (feet) — Length (hundreds of feet)
NAME FREQUENCY	VOR
NAME FREQUENCY	VORTAC (Distance Measuring Equipment Able)
NAME FREQUENCY	VOR/DME
NAME FREQUENCY	Non Directional Beacon
VOR/DME NAME FREQUENCY	If VOR falls directly on an airport, only the airport symbol will be shown. The VOR facility type is shown at the top of the box.

AIRPORT NAME ABBREVIATIONS

CO	County
FLD	Field
INTL	International
MUNI	Municipal
(PVT)	Private Airport (prior permission before landing)

ENLARGED SECTION SAN FRANCISCO AREA CHART

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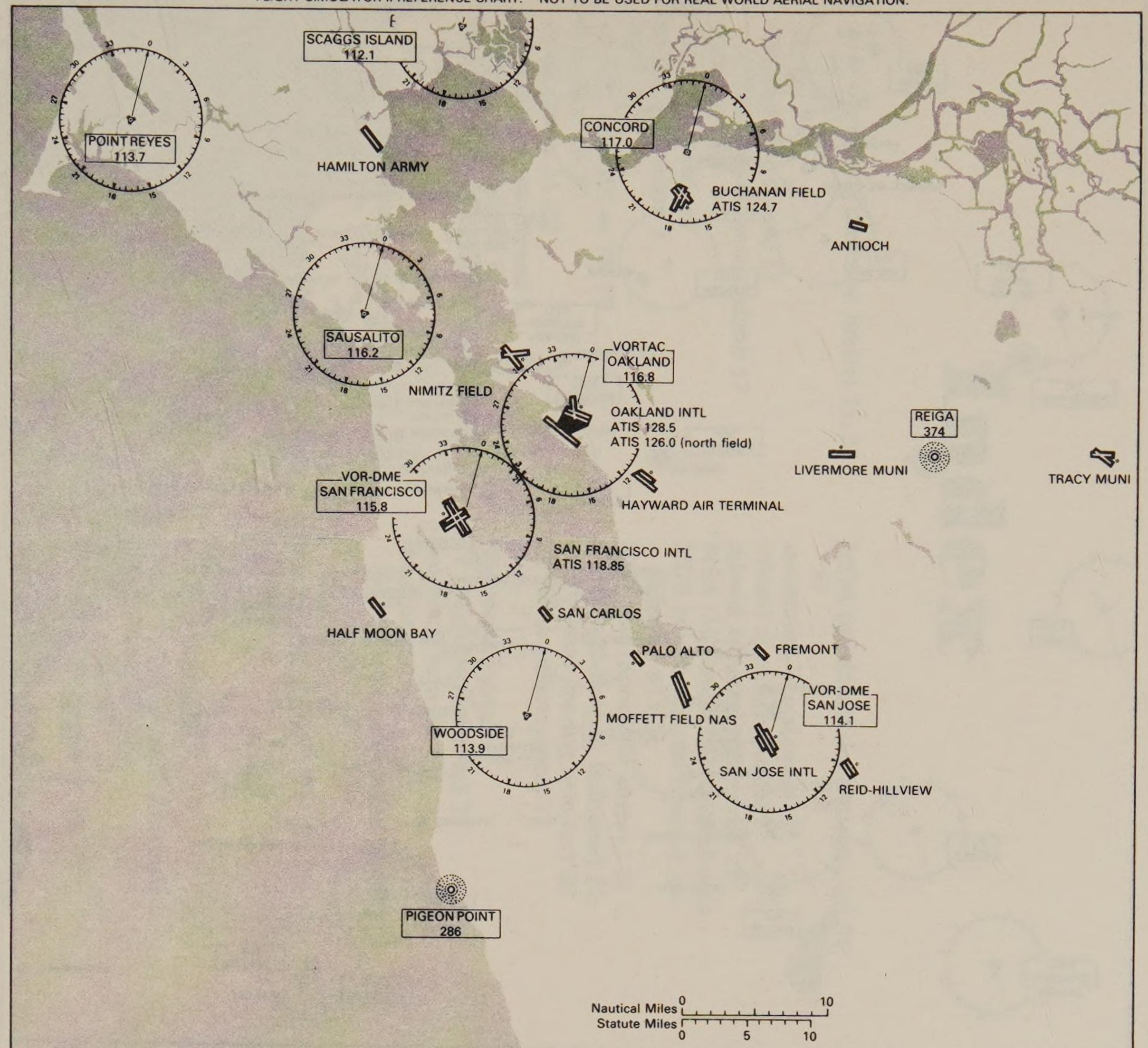

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AIRPORT DIRECTORY - SAN FRANCISCO AREA

CITY	AIRPORT	NORTH	EAST	ALT.	F (Fuel)	ILS (Rwy/Freq)
Alameda NAS	Nimitz Field	17402	5102	13		
Antioch	Anitoch	17407	5295	185		
Chico	Chico	18158	5567	239		
Columbia	Columbia	17269	5753	2116		
Concord	Buchanan Field	17449	5214	23	*	
Fremont	Fremont	17226	5177	4		
Fresno	Chandler Downtown	16671	5752	279		
Fresno	Fresno Air Terminal	16679	5795	331		
Garberville	Garberville	18514	5010	544		
Half Moon Bay	Half Moon Bay	17312	5004	67		
Hayward	Hayward Air Terminal	17329	5145	47		
Little River	Mendocino Co	18174	4895	571		
Livermore	Livermore Muni	17304	5247	397	*	25/110.5
Lodi	Kingdon	17408	5460	16		
Lodi	Lodi	17447	5503	59		
Marysville	Yuba Co	17840	5550	62		
Merced	Merced	16980	5608	154		
Minden	Douglas Co	17584	6104	4717		
Modesto	Modesto City	17172	5518	98		
Monterey	Monterey Peninsula	16862	5069	243		
Mountain View	Moffett Field NAS	17220	5134	34		
Napa Co	Napa Co	17571	5187	33		
Oakland	Oakland Intl	17365	5124	7	*	11/111.9 29/108.7
Oroville	Oroville	18003	5592	200		
Palo Alto	Palo Alto	17245	5119	5		
Placerville	Placerville	17591	5748	2585		
Porterville	Porterville	16294	5898	443		
Red Bluff	Red Bluff	18347	5500	348		
Reno	Reno Cannon Intl	17788	6176	4412		
Reno	Reno-Stead	17875	6169	5045		
Sacramento	Sacramento Metro	17681	5477	23		
Sacramento	Sacramento Exec	17595	5482	23		
Salinas	Salinas	16856	5161	85		
San Carlos	San Carlos	17281	5084	2		
San Francisco	San Francisco Intl	17340	5060	10	*	28L/109.5 12R/111.1
San Jose	San Jose Intl	17185	5164	56		
San Jose	Reid-Hillview	17160	5194	133		
San Rafael	Hamilton Army	17534	5082	3		
Santa Rosa	Sonoma Co	17756	5066	125		
Santa Rosa	Santa Rosa Air Center	17711	5066	98		
South Lake Tahoe	Lake Tahoe	17570	6016	6265		
Stockton	Stockton Metro	17312	5467	30		
Tracy	Tracy Muni	17258	5366	192	*	
Truckee	Truckee-Tahoe	17761	6031	5901		
Visalia	Visalia	16454	5831	292		
Watsonville	Watsonville	16995	5138	161		
Willows	Willows-Glenn Co	18087	5409	138		

North and east coordinates are canted at −20° (clockwise) to compensate for orthogonal coordinate grid overlaid on Lambert conformal conic projection.

Nautical Miles 0 10 20 30 40 50
Statute Miles 0 10 20 30 40 50

SAN FRANCISCO AREA CHART

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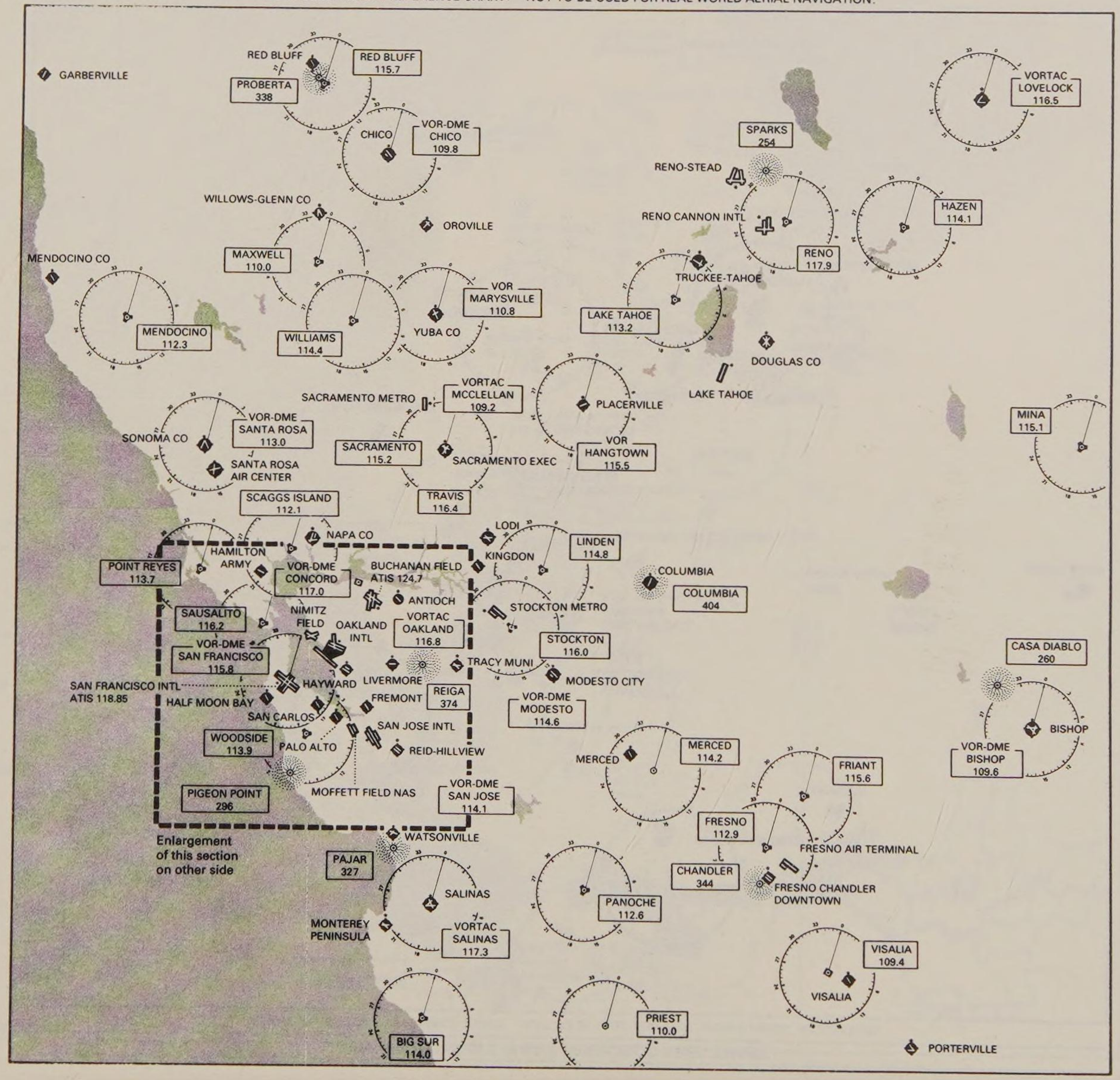

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